CLINICAL EVALUATION AND MICROBIOLOGICAL PROFILE OF NECROTIZING SOFT TISSUE INFECTIONS

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Dedicated

to

my family

&

Teachers

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"There is divine beauty in learning… To learn means to accept the postulate that life did not begin at my birth. Others have been here before me, and I walk in their footsteps. I am the sum total of their experiences, their quests. And so are you." -Elie Wiesel

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ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
BUN	Blood Urea Nitrogen
CRP	C Reactive Protein
CT	Computed Tomography
DNA	Deoxy Ribonucleic Acid
HIV	Human Immunodeficiency Virus
ICU	Intensive Care Unit
IL	Interleukin
INR	International Normalized Ratio
IV	Intravenous
LRINEC	Laboratory Risk Indicator for Necrotizing Fasciitis
LTA	Lipoteichoic Acid
MHC	Major Histocompatibility Complex
MRI	Magnetic Resonance Imaging
MRSA	Methicillin Resistant Staphylococcus Acinetobacter
MSSA	Methicillin Sensitive Staphylococcus Aureus
NF	Necrotizing fasciitis
NSAID	Non steroidal Anti Inflammatory Drugs
NSTI	Necrotizing Soft Tissue Infections
PFO	Perfringolysin O
PLC	Phospholipase C

PLT	Platelets
TLC	Total Leucocyte Count
TNF	Tumor Necrosis Factor
WS	Wound Swab

ABSTRACT

Introduction: Necrotizing soft tissue infections are life threatening infectious diseases, the hallmark of which is necrosis of soft tissue. Rapidly progressive in nature, they are associated with high risk of morbidity, mortality and often limb loss. Diagnosis is made based on clinical signs. Early diagnosis and urgent life-saving debridement is the mainstay of treatment.

Aim: To describe necrotizing soft tissue infections in terms of various clinical presentations including risk factors and to determine various microbial causes and to see their impact on patient mortality.

Material & Methods: This prospective study was conducted in 115 patients admitted with necrotizing soft tissue infections at Dayanand Medical College and Hospital, Ludhiana during the time period of December 2017 to September 2019.

Results: Most common presentation was middle aged (46%) male diabetics (60%) with complaints of swelling and pain of the extremities. Early cutaneous signs were more common and a single surgical debridement sufficed most patients. Mortality rate was 10.4%. Monomicrobial (89.6%) gram negative infections were more common than polymicrobial infections. Most common organism was E.coli. (40%) Fever, decreased urine output, presence of diabetes mellitus, chronic kidney disease, need for amputation, muscle involvement, Klebsiella pneumoniae infections (p-value=0.008) had a greater risk of need for intensive care**.** Decreased urine output, a BMI of less than 18, presence of blisters, need for amputation or diversion surgery, Acinetobacter baumannii infection (p-value=0.05), raised TLC (>20,000), Raised total bilirubin (>2g/dl), and Raised blood urea nitrogen (>58mg/dl) were associated with increased risk for mortality.

Conclusion: A high degree of suspicion is required, as patients do not always present with heralding cutaneous features, as represented by our study. Monomicrobial gram negative infections can also be common and patients may present with a predominance of early cutaneous signs. With urgent surgical debridement and early presentation, mortality levels can be as low as 10.4% as in our study.

Keywords: necrotizing soft tissue infections, NSTI, monomicrobial, E.coli.

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INTRODUCTION

Necrotizing soft tissue infections are uncommon life threatening infectious diseases, the hallmark of which is necrosis of soft tissue. Rapidly progressive in nature they are associated with high risk of morbidity, mortality and often limb loss. Depending upon the layer involved they can be necrotizing fasciitis affecting the fascia, necrotizing cellulitis affecting the skin and soft tissue and myonecrosis causing necrosis of the muscle. Together they can be grouped as necrotizing soft tissue infections as the treatment and outcome are usually similar. Been described as early as 5th century BC by Hippocrates,[1] the disease entity has been known by many different terminologies, from hospital gangrene, to phagedenic ulcer,[2,3] to erysipelas of the whole body, to Fournier's gangrene[4] to Meleney's synergistic gangrene.[5] The disease is still often misdiagnosed and hence there is delay in life saving debridement. Hence knowledge of the disease, its presentation, the risk factor involved and causative organism is important to effectively treat a sometimes inevitably fatal illness.

Historically thought to be caused purely by Group A Beta-hemolytic Streptococci[6] the so called "flesh eating bacteria", and thought to be associated with toxic shock syndrome, it is now known that the disease can be caused by a wide plethora of infectious microorganisms. Most commonly seen are polymicrobial infections- Meleney's so called "synergistic gangrene".[5] Apart from polymicrobial infections, monomicrobial infections especially with MRSA[7] and Klebsiella[8] are an upcoming trend. As the causative organism also impacts the intravenous antibiotics needed and the pattern of disease progression and pathogenesis, the need to know the most common causative organism is also of prime importance. Although the extremities and perineum are the most commonly afflicted parts, the disease can affect almost any part of the body.

Commonly seen in middle aged diabetics,[9] the disease can also present In healthy, young, immunocompetent adults. Usually, the patient presents

with history of trauma, even a trivial one followed by swelling and erythema of the afflicted part, usually a limb, with pain out of proportion to the signs.

The diagnosis is based purely on clinical findings. Imaging, such as CT scan or MRI may aid is diagnosis but are not as helpful and not generally employed in patients presenting with frank sepsis, shock, altered sensorium and deranged renal function, as is usually the case. As the pathognomonic signs, such as necrotic patches, bullae, crepitus and frank gangrene of the limb, present late in the natural history of the disease, diagnosis requires a high degree of suspicion. Early onset of sepsis, hypotension, renal failure, respiratory distress in a suspected case of cellulitis should help point towards the diagnosis of necrotizing fasciitis as compared to less severe and morbid infections such as cellulitis.

Early debridement is the cornerstone to treatment. Studies have proven delay in debridement can lead to increased risk of mortality including an increased risk of morbidity, in the form of increased hospital stay, need for intensive care, multiple debridements and amputations.[10]

The disease is often misdiagnosed and hence, many times the urgent surgical debridement required in such cases is delayed by hours and days.[10] Hence it is important to know the clinical presentation and signs, the various risk factors and the most important causative organism for antimicrobial cover.

In this descriptive study, we have prospectively followed 115 patients presenting to DMCH with necrotizing soft tissue infections. Diagnosis was made based on clinical features and operation theater findings. The presence of risk factors was noted, along with the presence of sepsis, hypotension and renal failure and biochemical abnormalities. Cultures were grown from samples taken intra-operatively or post-operatively in the form of wound swab, tissue or pus taken in an aseptic manner.

The most common clinical features, risk factors, biochemical abnormalities and microbiological pathogen implicated were enumerated and compared with morbidity in the form of need for intensive care and mortality.

We hope this study will increase awareness of a rare but potentially fatal illness that can be cured if diagnosed and treated in time.[10]

AIMS AND OBJECTIVES

- To determine various clinical presentations including risk factors.
- To determine various microbial causes.

REVIEW OF LITERATURE

HISTORY

As old as 5th century BC, Hippocrates is quoted as describing a rapidly spreading flesh eating morbid disease "*Many were attacked by the erysipelas all over the body when the exciting cause was a trivial accident or a very small wound. Many even while undergoing treatment suffered from severe inflammations, and the erysipelas would quickly spread widely in all directions. Flesh, sinews, and bones fell away in large quantities.... there were many deaths. The course of the disease was the same to whatever part of the body it spread. Many lost the arm and the entire forearm. But the most dangerous of all such cases were when the pubes and genital organs were attacked*".[1] This is none other than what we today know as necrotizing fasciitis or necrotizing soft tissue infections.

During the American Civil War, American Confederate Army surgeon Dr Joseph Jones described over 2400 cases of necrotizing soft tissue infections which he found to have a 46% mortality rate at the time.[2] In the 1880s, many cases of "hospital gangrene" were described when surgeons noticed that many trauma patients developed rapidly progressive gangrene and necrosis post amputation which they felt was a hospital acquired infection.[3] Owing to the rapidly progressive necrotizing nature of the illness, they named it a "phagedenic ulcer". "*The thigh was of tallowycolour, swollen to twice the size of the sound limb; a blush extended upwards from the incisions, which were covered with a shreddy, grey discharge. The term "hospital gangrene" does not rightly express the character of the affection; and I consider "sloughing phagedsena" a far more accurate name for it. The French word "pourriture", signifying "the rottenness of decay," is more expressive of its course than any word in the English language*.[2,3]

In 1882, a similar syndrome of unexplained gangrene occurring in the penis and scrotum of young healthy males was described by Fournier.[4] The infection developed abruptly and progressed rapidly to gangrene. Till

date, synergistic necrotizing fasciitis of the perirectal, perineal or genital areas is known as Fournier's gangrene. Endarteritis caused by the spread of microorganisms in the subcutaneous space causes thrombosis of small subcutaneous vessels causing gangrene in overlying skin. The resultant ischemia allows further proliferation of variety of pathological organisms in the subcutaneous space.

It was only in the 1920s, that Meleney discovered a specific microbial cause for the illness- a synergistic infection with Streptococcus and Staphylococcus.[5] Meleney noticed a rapidly progressive necrotic surgical site infection in post appendectomy patients which caused morbidity, sepsis, was difficult to control with dressings done by "Dawkin's method" alone and required extensive debridement. He called it "Meleney's gangrene". He inoculated the bacteria grown in cultures in dogs, hereby verifying Koch's postulate and discovering that both bacteria were required for the extensive necrosis the disease presented with. Hence, Meleney's "synergistic" gangrene was discovered.

It was only in 1952 that Wilson coined the term "Necrotizing fasciitis".[11] Today Necrotizing fasciitis includes all necrotizing soft tissue infections including necrotizing cellulitis and myonecrosis.

PATHOPHYSIOLOGY

Necrotizing soft tissue infections are characterized by necrosis of soft tissue usually along with rapidly progressive sepsis and shock.

It was classically known to be caused by Group A Beta-hemolytic Streptococci, also quoted as the "flesh eating bacteria".[12] Group A Beta-Hemolytic Streptococcal infections of soft tissue, occurring through epidermal breach, spread more aggressively than Beta hemolytic Streptococcal infections of mucous membranes. This is owed to exotoxins and M-proteins displaying super antigen activity.[13] Due to super antigen activity the antigen binds directly to V_b domain of T-cell receptor, therefore bypassing binding of antigen to Antigen presenting MHC-II molecule and hence activates of 2-20% of T-cells as opposed to only 0.01% of T-

cells.[13] This causes an inflammatory response of much larger magnitude with the release of pro-inflammatory cytokines upto two to threefold times greater than that of an ordinary antigen. Two to threefold time greater release of IL-1, IL-6 and TNF-a produce the rapidly progressive life threatening sepsis and shock associated with NSTIs. The super inflammation further suppresses adaptive immunity. The exaggerated inflammatory response causes widespread thrombosis of blood vessels causing the characteristic necrosis of soft tissue and also prevents host immune response to control the infection. Initially, skin is spared due to increased collaterals but later on gets involved as the disease evolves. Surface proteins M1 and M3 help Streptococci become adherent to tissues and spare itself from phagocytosis. M proteins contain LTA (Lipotechoic acid) which helps the bacteria to become adherent to tissues. LTA present at the projecting end of fimbriae interacts with fibronectin of host cell membrane and helps it to adhere to host epithelium. It also prevents the bacteria from being cleared by secretions and resist phagocytosis. Certain strains also contain F-proteins which possess similar adherent qualities.

Another virulence factor is the wide range of exotoxins released by the organism such as Streptolysin S, Streptolysin O and pyrogenic exotoxins A, B and C. Streptolysin O and S cause cell damage and death with degranulation of neutrophils which perpetuates local cell injury due to the release of lysosomal enzymes which is known as the so called “respiratory burst”. Streptokinase digests fibrin and lyses clots, causing rapid spread of bacteria. Streptodornase, which are Streptodeoxyribonucleases, degrade viscous DNA in necrotic tissue. That, along with hyaluronidase, which destroys cell structure, reduces the viscosity of pus to form the characteristic “dish water pus” which is easily transmitted along the fascial planes. Streptococcal pyrogenic exotoxins are implicated in Toxic Shock Syndrome, hence its occasional coexistence with NSTI.

Almost all organisms causing NSTIs have similar exotoxins or tissue degrading enzymes.

Clostridial gas gangrene is characterized by extensive local destruction of muscle, or myonecrosis, rapid tissue destruction, shock and even death. The organism owes its virulence to its own set of exotoxins- Theta exotoxins: Perfringolysin O or PFO and Alpha toxins: Phospholipase C or PLC.[14]

Trauma introduces bacteria into the wound and creates a low tension and low pH environment with low redox potential for the anaerobic organism.

Phospholipase C induces activation of Glycoprotein II_b/III_a and causes the activation of the formation of large platelet-neutrophil complexes which cause microvascular thrombosis and leads to irreversible decline in muscle perfusion. This leads to necrosis- the hallmark of necrotizing soft tissue infections. PLC is the main virulence factor which is hemolytic, increases capillary permeability and cleaves eukaryotic cell membranes. Patients with Clostridial gas gangrene go into shock and hypotension early due to the direct and indirect effects of the exotoxins. PLC causes a direct effect on myocardial contractility, reducing the cardiac output. PFO causes activation of inflammatory cytokines and causes vasodilation by releasing Nitrous oxide via macrophages and endothelial cells causing profound hypotension, reduced systemic vascular resistance and thus reducing the cardiac output further.

Apart from Streptococcus and Clostridium, most necrotizing soft tissue infections are polymicrobial in origin.[15] Growth of anaerobic and aerobic bacteria is facilitated by low oxygen tension and redox potential of the wound.

Polymicrobial infections occur via the creation of biofilms by the micro-organisms.[15] These biofilms enable colonization and help protect bacteria from host immune response. These biofilms are made of polysaccharides which provide an optimal environment for microbial survival. Pathogenic organisms generate an appropriate environment for other pathogenic

organisms. These biofilms harbor nonpathogenic organisms and they synergistically become virulent. The virulence exhibited by these organisms cannot be attributed to a single organism alone- hence, the polymicrobial cause of disease- “synergistic gangrene” as proposed and proven by Meleney in 1920.[5]

ETIOLOGY AND CLINICAL FEATURES

The disease has an acute onset. Rate of progression can vary from a few days to rapid decline and death within a few hours.[16] The inciting factor may be trauma, which is the most common identifiable etiology, in which the wound provides an excellent environment for both anaerobic as well as aerobic bacteria and polymicrobial growth.[15] The most common form, Fournier’s gangrene, affects the perineum and may occur most commonly after anorectal infections, genitourinary infections, traumatic injuries, ischiorectal, perianal and intersphinteric abscesses.[4] It can also occur post anorectal surgical procedures and in the setting of colorectal neoplasms, rectal perforations, urethral strictures and even coital injuries.[4] A necrotizing fasciitis of the abdominal wall is usually a post-operative complication of abdominal surgery- usually where there is fecal contamination- Appendicitis with perforation, as described by Meleney, incarcerated hernia repair, viscous perforation, gangrenous cholecystitis, intestinal obstruction are common causes, with perforation being the leading cause. In the extremities, the most common etiology is trauma, which may even be trivial, or intravenous drug abuse.[4]

Initially, the disease affects the superficial fascia, leaving the skin, characteristically unremarkable in the initial phases of the disease. As bacteria proliferates and toxins are released, localized necrosis ensues involving the deep fascia and localized soft tissue. The disease spreads further in the horizontal plane leaving the skin appearing normal. In this stage the disease may seem indistinguishable from less severe soft tissue infections such as cellulitis. The main distinguishing factor is pain out of proportion to signs and early onset of systemic toxicity- in the form of

shock, hypotension, tachycardia, decreased urine output, fever and other system involvement.

After the horizontal spread, there is vertical spread and the thrombosis of vessels. Thrombosis of vessels aids in extension of necrosis and protecting the pathogens from host immune response with the inability of phagocytes to reach the site of infection. Microvascular occlusion also contributes to the shock and organ dysfunction. The involvement of the perforating vessels to the skin leads to skin involvement. These lead to the characteristic skin signs of the disease.

Classic presentation is of limb swelling with severe pain and underlying crepitus. Pain is disproportionate to signs in the initial stages, with edema and tenderness.

Patient can present with diaphoresis, tachycardia, and anxiety. Later on complications can develop such as hypotension, renal failure, metabolic acidosis, fever, hyponatremia, shock, coagulopathy, thrombocytopenia, liver failure, hypothermia. Along with necrosis, skin changes such as ecchymosis, blisters, bullae, necrotic plaques start to develop.

Based on the cutaneous signs, necrotizing fasciitis can be classified into different stages:[17]

Stage 1: Patient has erythema, tenderness beyond erythema, swelling, and local rise of temperature. In this stage, it is hard to distinguish the disease from cellulitis and erysipelas except for the disproportionate pain and presence of systemic signs that would be absent in less severe infections.

Stage 2: This stage begins with the onset of critical skin ischemia. Patient has skin bullae, blisters, and skin fluctuation. Blisters are formed by ischemia induced necrolysis. These blisters should help raise suspicion towards a NSTI and are usually not present in cellulitis and erysipelas.

Stage 3: As the disease evolves, there is frank necrosis of tissues. This leads to the presence of hemorrhagic bullae, skin anesthesia, necrotic patches and frank gangrene.

Leppard and Seal in 1983 suggested the existence of a subacute variant of the disease with a less fulminant clinical course, developing over days and weeks with eschar formation.[18] But later on, this was disproved by Baker et al, in their histological study of the disease.[19]

RISK FACTORS

The disease, if not managed early with prompt surgical debridement, leads to a morbid course and even death. [10] Although rare in incidence, with 500-1500 cases per year in the United States, the mortality rates are 17-34%.[20] Wong et al, created a scoring system to determine risk of mortality called LRINEC or Laboratory Risk Index for Necrotizing fasciitis which calculated the risk of mortality based upon certain lab criteria such as total leukocyte count, hemoglobin, CRP, sodium, creatinine, glucose.[21] Certain pre-existing conditions increase the risk of a patient to develop NSTIs. They include advanced age, diabetes mellitus, alcoholism, peripheral vascular disease, chronic renal failure, heart disease, AIDS, malignancy, NSAID use, iv drug abuse, trauma, obesity, Systemic lupus erythematosus, Addison's disease, hypertension, decubitus ulcer, perianal abscess, surgical site infection, chronic skin infection, recent surgery especially for perforated viscous, recent child birth, chronic liver disease, recent Varciella Zoster infection especially in children.[20] But these risk factors may not always be present. In Asia, consumption of raw or undercooked seafood or injury by fish fins can cause necrotizing fasciitis by the so called "marine bacteria"- Vibrios and Aeromonas.[22] As discussed previously, Fournier's gangrene mainly occurs post perianal infection, urogenital trauma, neoplasm or surgical intervention in males. In females, Fournier's, although uncommon can occur post vulval abscesses, following episiotomy, hysterectomy, septic abortion or cervical/pudendal nerve block.[4]

The most frequently occurring risk factor present is diabetes mellitus.[9] High blood glucose levels leads to hyperosmolarity of blood, leading to tissue dehydration and if uncorrected, organ damage. Poor blood circulation, owing to atherosclerosis, along with neuropathy leads to increased risk of infection. Neuropathy enables these infections to go unnoticed for long periods of time until they develop into more serious illness. The defects in wound healing and poor immunity in these patients' leads to delayed resistance to infection.[15]

Advanced age is also an important risk factor, with the mortality of upto 67% in patients above 50 as compared to those below 50 years of age.[20] This increases with the presence of other co-morbidities and risk factors.

Increased serum lactates and creatinine kinase, high creatinine and renal failure, high BUN, low hematocrit and albumin, hyponatremia, deranged INR and systemic acidosis are all associated with increased risk of mortality.[10]

TYPES OF NECROTIZING SOFT TISSUE INFECTIONS

Based upon the microbiological cause of disease, necrotizing soft tissue infections are divided into various types:[23,24]

Type I: Type one consists of polymicrobial infections. This is the most common form of the disease. Causative microorganisms include a combination of gram-positive cocci, gram negative rods and anaerobes. Most frequently they occur as Fournier's gangrene or in the trunk of patients with pre-existing comorbidities such as Diabetes mellitus, obesity, chronic kidney disease, iv drug abuse, chicken pox and perforation of a hollow viscous.[15]

Type II: This is the typical infection by the "flesh eating"[12] Group A Beta-hemolytic Streptococci. Infection can be present in adjunct with Staphylococcus aureus infection. Due to its superantigen activity patient can also present with toxic shock syndrome and deteriorate suddenly. This type is commonly present in the extremities and risk factors may or may not be present.[11,13,15] This type is less common than the

polymicrobial variant but with the rise of MRSA, it's incidence is increasing.[7] These infections occur in young, immunocompetent individuals and may or may not be associated with risk factors. History of trivial trauma and abdominal surgery may be present.

Type III: Monomicrobial infection with gram negative bacteria. It's uncommon but carries a high mortality. One prominent organism in this category is Vibrio.[22]

Type IV: Certain authors have described fungal infections as type IV. These infections are usually present in burns patients and post trauma or highly immunocompromised individuals.[23]

One of the prominent organisms whose incidence is increasing in skin and soft tissue infections is Methicillin Resistant Staphylococcus aureus-MRSA.[7] With injudicious use of antibiotics, Methicillin isolates are the most common isolates of Staphylococcus aureus infections. Necrotizing soft tissue infections, usually known to be caused by polymicrobial flora, is showing increased incidence of monomicrobial pathogens with MRSA becoming one of the most commonly isolated organisms from soft tissue infections with an incidence of around 8-20%. In a study by Miller et al, the incidence of MRSA necrotizing fasciitis was upto 29%.[7] MRSA infections although do not show a statistically significant increase in mortality rates.

Acinetobacter is slowly becoming a major cause of infection amongst wounds and soft tissue; especially in traumatic injuries post floods or earthquakes. Recent reports show an increased incidence of Acinetobacter baumannii to be a cause of necrotizing fasciitis and soft tissue infections.[25] Necrotizing infections caused by Acinetobacter are usually severe and associated with sepsis and shock. With the rise of antibiotic resistance, Acinetobacter earlier considered an infection of low virulence is now becoming significant causing life threatening sepsis. The incidence has increased especially with increased usage of mechanical ventilation, central venous and urinary catheterization and injudicial antibiotic therapy in the hospital setup and nosocomial infections. Apart

from nosocomial infections, Acinetobacter can also be community acquired in mostly immunocompromised patients such as those with HIV, cirrhosis, Diabetes Mellitus and usually but not always may have preceding trauma. Acinetobacter is becoming an important nosocomial pathogen especially in ICU set ups around the world with an increased incidence in India.[25]

Escherichia coli is not a common cause of necrotizing fasciitis and soft tissue infections as per literature. Usually if present, it is present in polymicrobial diseases and E.coli as a monomicrobial cause of necrotizing fasciitis is rare.[26] If present, it usually presents with a severe form of the disease with severe septic shock and prominent cutaneous signs such as bullae. The strain found to be involved are extraintestinal and are capable of producing a necrotic toxin hence causing the disease.[26]

Monomicrobial Necrotizing fasciitis caused by Klebsiella pneumoniae is a prominent presentation. In a study conducted in Taiwan, majority of their cases were caused by Klebsiella pneumoniae infection.[8] They found the disease to have high mortality and morbidity with risk of limb loss. These cases typically occurred in patients with underlying immunocompromising conditions, such as diabetes mellitus or liver cirrhosis. Some cases were noted to have a concomitant distant abscess, including endogenous endophthalmitis and abscess in liver and kidney. Most cases showed bullae, crepitus and bacteremia.

Another upcoming cause is the marine organism, Vibrio vulnificus which is associated with severe hypotension due to cardiovascular collapse due to its massive inflammatory response.[22] This leads to increased risk of morbidity and mortality. Once patient is initially resuscitated, urgent debridement is mainstay of treatment.

DIAGNOSIS

The diagnosis of Necrotizing fasciitis is a clinical one and requires a high degree of suspicion because the pathognomonic signs present themselves later on as the disease progresses.[17] Clinical history taking

and meticulous physical examination are essential to establish an early diagnosis.[10] The patient appears to be ill despite the absence of cutaneous signs. The patient complains of pain out of proportion to signs. Usually patient presents with a toxic look, tachycardia and sometimes even frank septic shock. A septic patient with simple swelling not responding to treatment should raise the suspicion of necrotizing fasciitis. Some of the early cutaneous signs include skin anesthesia, erythema, edema, local rise of temperature and localized pain and tenderness out of proportion to the signs. Sometimes crepitus may be felt. Bullae, skin necrosis, seropurulent exudates, foul odor appear later on in the disease. Thrombocytopenia is common. Hypocalcemia may be present.[10] Leucocytosis is usually present. Hyponatremia may be present and is usually associated with a severe outcome.[10] Edema leads to hypovolemia and hypoalbuminemia exaggerates it. Patient mortality has been associated with deranged serum creatinine and high lactates on presentation.[10,16]

Imaging has little value in necrotizing fasciitis but can be used when the diagnosis is uncertain.[27] Not only can imaging delay the time between disease onset and urgent necessary lifesaving debridement, it is usually inconclusive.[28]

Plain X rays are not very useful but may sometimes show air in the subcutaneous planes in the form of subcutaneous emphysema. The absence of subcutaneous emphysema does not rule out necrotizing soft tissue infections and hence it is not a very sensitive investigation. Apart from that, in the cases of trauma it helps to rule out any underlying fracture of bone.

CT scans provide accurate images and help determine the presence and extent of the soft tissue along fascial planes and the presence of gas. Earlier in the disease process we see edema and fluid tracking along fascial planes with or without air foci. Other suspicious signs include fascial thickening and stranding. Asymmetrical thickening with stranding

was found in 80% of cases and was found to be the most common and sensitive sign.[27] The sparing of skin and superficial epidermis helps differentiate from simple cellulitis and other skin infections. CT scans are more useful in the case of intra-abdominal or retroperitoneal pathologies.

MRI with gadolinium enhancement is more accurate in determining necrosis of fascia and extent.[28] But considering the time required to do an MRI, inability of the patient to move during the scan and need for contrast, it is not very useful in an acute patient with shock, altered sensorium and deranged RFT with decreased urine output, as is the usual presentation. It can be useful in stable patients or subclinical variants where the diagnosis is under debate.

Ultrasonography can be useful especially in the case of Fournier's gangrene where it can be used to separate it from other causes of acute scrotum like testicular torsion, tumor, abscess and epididymo-orchitis.

Some entities that may be the differential diagnosis of necrotizing fasciitis and soft tissue infections on imaging include cellulitis, dermatomyositis, vasculitis, diabetic myonecrosis and compartment syndrome.[27]

A bedside frozen section is the only way to objectively confirm the disease.[10] It shows changes in the form of subcutaneous necrosis, polymorph infiltration, vascular thrombosis, microorganisms. It can also help rule out fungal infections. Gram staining of biopsy helps diagnose Clostridial myonecrosis with the presence of gram positive rods with boxcar ends. Frozen sections or biopsies help achieve earlier diagnosis.

Despite imaging modalities and frozen sections, the gold standard for diagnosis is clinical examination by an experienced surgeon followed by on table operation findings during surgical exploration with deep incisional tissue cultures.[23]

MORTALITY

Studies have proven the time between presentation and surgical debridement directly affects mortality of the patient. Delay of surgical debridement by 12 hours can increase the mortality to upto 32%.[29]

In the initial phases, the paucity of clinical cutaneous signs makes it indistinguishable from less severe soft tissue infections.[17] This often causes misdiagnosis and delay in necessary lifesaving debridement leading to the disastrous onset of systemic toxicity.

Numerous studies have shown that the single most important determinant of mortality is timing and adequacy of initial debridement.[29] Mok et al, found the risk of death is 7.5 increase in mortality if diagnosis and initial debridement was delayed by 24 hours.[30] Wong et al, reported a nine fold increase in mortality.[21] Bilton et al, showed mortality increased from 4% to 38% with delay in debridement.[29]

Mortality in Necrotizing Soft Tissue Infections is a debated issue. Goh et al, concluded a mean mortality is 21.5%.[31] Of that, in literature, mortality of necrotizing soft tissue of the limbs is comparatively less as compared to Fournier's gangrene and abdominal necrotizing soft tissue infections.[4]

In a study conducted by McHenry et al, they determined the most important risk factors associated with mortality were obesity, diabetes mellitus, hypoalbuminemia, peripheral vascular disease, corticosteroid use, iv drug abuse.[32]

The cornerstone of management is prompt surgical debridement. As discussed earlier, any delay in surgical debridement can be fatal.[29]

TREATMENT

The moment the patient arrives, history taking and clinical examination are done. Patient is resuscitated. If needed, a central venous catheter and a Foley's catheter may be placed. Fluid resuscitation, cardiovascular stabilization and preoperative preparation are of prime importance initially. Patient is started on intravenous antibiotics. As most cases are polymicrobial,[15] patient should be started on empirical broad spectrum antibiotics. Subsequent management should be guided as per growth of cultures, ideally taken intra-operatively. Initial empirical coverage should be affective against gram positive cocci, gram negative rods, and anaerobes.

Intravenous Clindamycin or Metronidazole should be used for anaerobes such as Bacteroides, Fusobacterium, and Peptostreptococcus. Clindamycin can also be used to inhabit toxin production in the case of Group A Beta hemolytic Streptococci and toxic shock syndrome.

Gentamicin or other aminoglycosides may be used for Gram negative organisms such as Enterobacter, if the renal function allows. It has a synergistic effect with penicillin against Streptococci.

Carbapenams such as Imipenam and Meropenam can be used in case of septic patients where drug resistance may be suspected. Advantages of carbapenams are high lactamase resistance, wide spectrum efficacy, inhibition of endotoxin release.

Postoperatively, antibiotics are adjusted according to culture.

Tetanus prophylaxis is important in patients with necrotizing soft tissue infections, especially those with history of trauma. Tetanus is a known complication of infectious gangrenes.[10]

In patients with fungal infections, especially Mucormycosis, there is high risk of death.[10] Patients are treated with Amphotericin B or liposomal Amphotericin B in the onset of renal dysfunction.

In patients with suspected Clostridialmyonecrosis, intravenous penicillin should be administered. If allergic, clindamycin or metronidazole should be substituted.

Urgent Surgical debridement is lifesaving in the case of necrotizing soft tissue infections.[29] Once diagnosed, patient should be taken up for immediate debridement. Incisions to fascia reveal dishwater pus and all necrotic tissue should be excised. Due to rapid progression, sometimes patients require multiple debridements after 24-48 hours to control infection adequately.

In the case of disseminated intravascular coagulation, patient may require the transfusion of blood and blood products before and during debridement.

Reconstructive surgery should only be considered once the patient is stable and disease fully eradicated. Sterile dressings are used to cover the wound and determine progress. Wound coverage can be achieved either using split skin grafts or tissue transfer.

Vacuum assisted closure (VAC) therapy may be employed to promote healing and help close wounds especially In the case of larger defects. Several studies promote the use of VAC dressings.[9] A VAC device consists of a sterile, open cell foam sponge placed in the wound according to the wound size. This is covered with adhesive to create and air tight vacuum. This is attached to a portable pump which provides continuous negative pressure. VAC enables better wound healing and a significant reduction in surface area.[9] VAC dressings are changed ever 24-72 hours.

In certain cases, limb amputations may be needed in case of septic limbs in the form of life saving surgery. In cases of non-healing perineal infections, colostomy may be done to help prevent the wound from being contaminated with feces. In cases of Fournier's gangrene sometimes orchidectomy may be required.[4]

The role of hyperbaric oxygen has been debated. It is postulated that hyperbaric oxygen increases the tissue oxygen tension in zones of infected hypoxic areas help preventing disease extension by having a direct antibacterial effect on anaerobic bacteria and by decreasing the levels of endotoxins especially in the case of certain Clostridial bacteria. Hyperbaric oxygen is said to improve wound healing by facilitating fibroblast proliferation.[33] Shupak et al proved that there was no statistically significant difference in the mortality rates in patients with necrotizing soft tissue infections with or without hyperbaric oxygen therapy.[34]

Early enteral nutrition, as in the case of almost all diseases is important for early healing of wounds and infections. Adequate nutritional support is necessary either enterally or parenterally to establish a positive nitrogen balance.

Anaya et al have postulated the role of intravenous immunoglobulins in the treatment of necrotizing soft tissue infections especially those associated with Group A streptococcal infection with toxic shock syndrome.[35] It is postulated that IVIG binds to Staphylococcal and Streptococcal derived exotoxin limiting cytokine and systemic inflammation. Lu et al, showed that kallistatin can increase the risk of group A streptococcus in mice.[36]

MATERIALS AND METHODS

SOURCE OF DATA

Data was collected from all patients with Necrotizing soft tissue infections, who were admitted in the time period of December 2017 to September 2019 according to the inclusion and exclusion criteria.

METHOD OF COLLECTION OF DATA

Information was collected through a predesigned pretested proforma for each patient.

- All patients were interviewed as per the proforma and a complete clinical examination was done.
- Cultures of patients were collected either intra operatively or pre /post operatively in the form of wound swab culture, tissue culture or pus.

Culture samples were sent in sterile containers.

Typically, routine aerobic cultures were sent.

Samples were first grown on MacConkey's agar and Blood Agar.

Gram staining was done once a growth was observed.

For gram negative growths, MacConkey's agar was used and for gram positive Blood Agar was used for further analysis.

Growth was further continued either manually with drug sensitivity checked by Kirby-Bauer method or automated in Vitek 2.

Similarly, anaerobic cultures were first passed through Robertson's meat broth medium and then grown on blood agar and fungal cultures were grown on Sabouraud's dextrose agar.

Inclusion criteria

- Any patient above 18 years of age with necrotizing soft tissue infections requiring treatment in the form of surgical debridement

Exclusion criteria

- Patients less than 18 years of age
- Patients unwilling for treatment

Sample size: Time bound study.

Period of follow-up: Within hospital stay

Duration of the Study: December 2017 to September 2019.

Outcome: To find the most common clinical presentation of disease with microbial cause and common risk factors associated with the disease and to associate them with mortality and need for intensive care.

Statistical Analysis: Data were described in terms of range; mean ±standard deviation (± SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the groups was done using Student t-test an. For comparing categorical data, Chi square ($\chi 2$) test was performed and exact test was used when the expected frequency is less than 5. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

OBSERVATIONS AND RESULTS

This prospective study involved 115 patients with necrotizing soft tissue infections presenting to our center between December 2017 and September 2019. Diagnosis was made based on clinical features and intra operative findings, all patients were started on intravenous antibiotics at the time of admission.

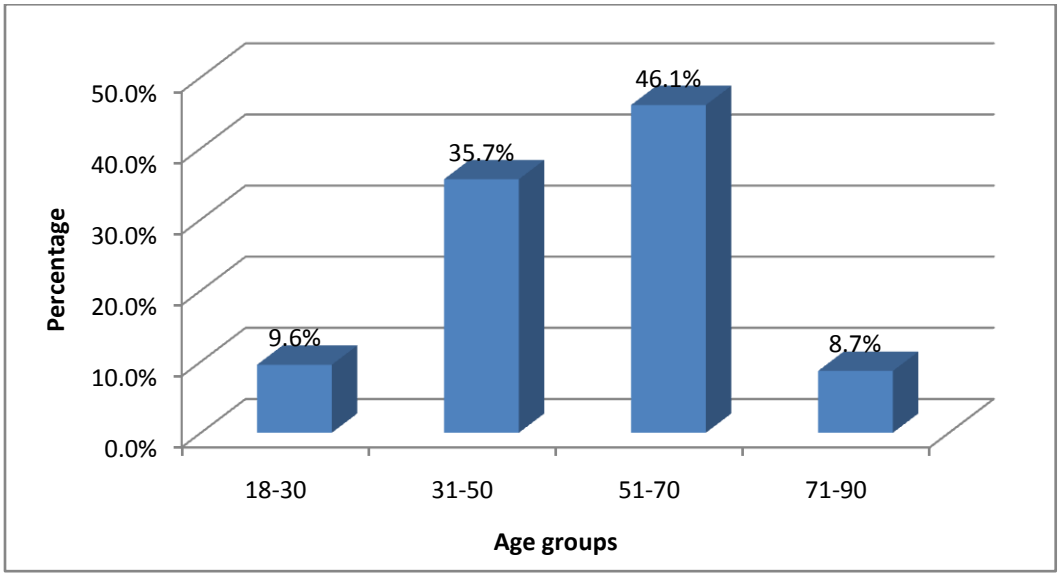
Demographic Data:

Age- The age range of patients was from 18 to 86 years old with a mean age of 52.3 years. Most patients belonged in the 51-70 year age group (46%) followed by the 31-50 year age group (35%). The least number of patients were in the 71-90 year age group with a percentage of 8.7 of the whole.

Table 1: Distribution of age groups in percentage

AGE GROUP	No. of cases	Percentage
18-30	11	9.6%
31-50	41	35.7%
51-70	53	46.1%
71-90	10	8.7%
Total	115	100.0%

Figure 1: Distribution of age groups in percentage

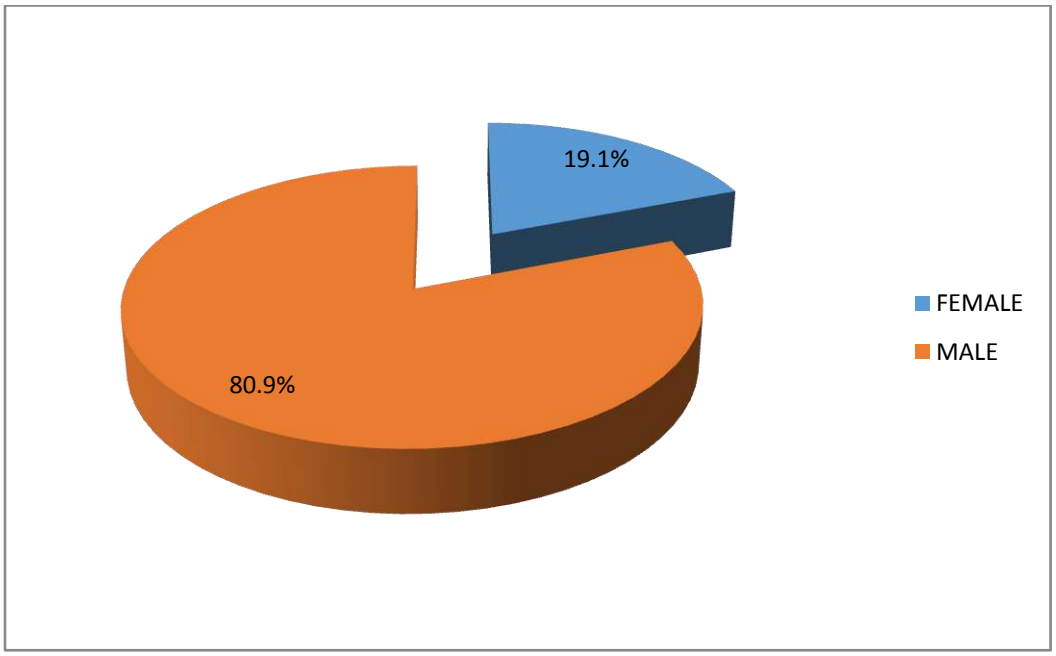


Sex- There was a male predominance. Out of 115 patients, 93 were Male (80.9%) and 22 were female (19.1%).

Table 2: Distribution of patients according to sex in percentage

SEX	No. of cases	Percentage
FEMALE	22	19.1%
MALE	93	80.9%
Total	115	100.0%

Figure 2: Distribution of patients according to sex in percentage



Etiology and Risk factors:

The classical history of trauma, either grave or miniscule was present in only 26 (22.6%) patients. The rest presented with swelling (n=109, 94.8%) and pain (n=12, 97.4%) of insidious onset. Four patients had history of snake bite (3.4%) and seven patients developed NSTI after history of unrelated surgery (6%).Fever (n=74, 64.3%) and decreased urine output (n=38, 33%) was less common, demonstrating that patients sought treatment in early stages of the disease.

Table 3: Distribution of patients according to presenting complaint

Presenting complaint	n (%)
Pain	112 (97.4)
Swelling	109 (94.8)
Fever	74 (64.3)
Oliguria	38 (33)
Trauma	26(22.6)

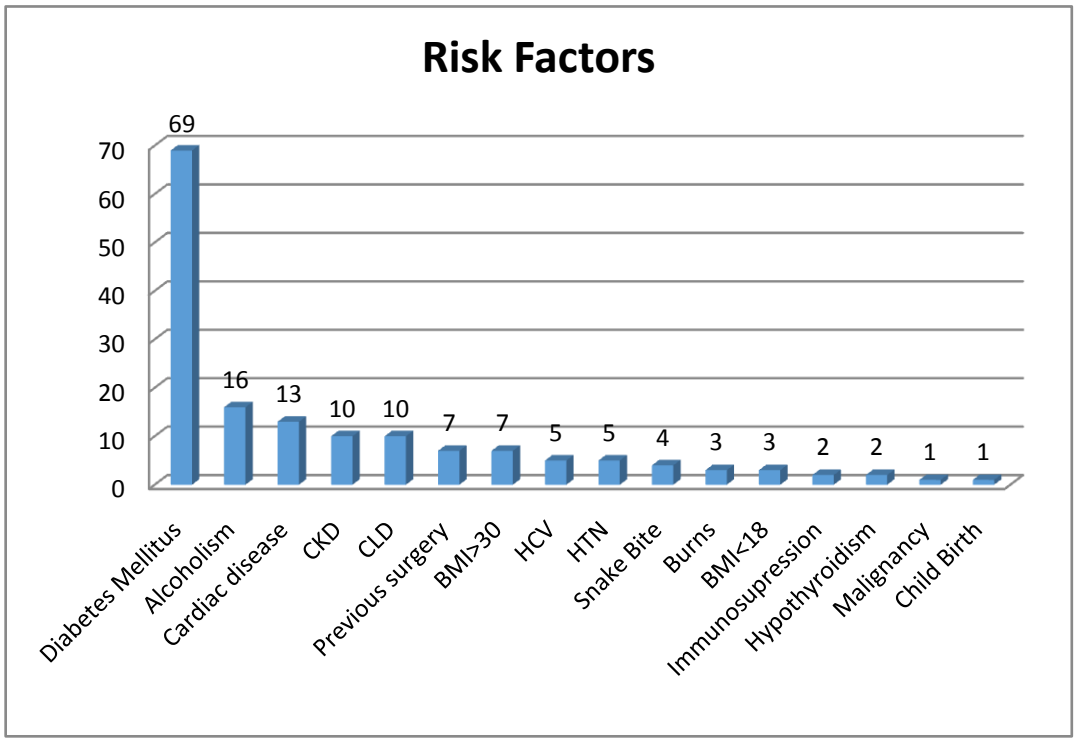
Risk factors:

The most common risk factor in our patients was diabetes, followed by alcoholism and cardiac disease.

Table 4: Risk Factor Distribution in number and percentage

Risk factor	n (%)
Diabetes Mellitus	69(60)
Alcoholism	13(11.3)
Chronic Kidney Disease	10 (8.7)
Chronic Liver Disease	10 (8.7)
H/o previous surgery	7 (6)
BMI >30	7 (6.1)
Hepatitis C	5 (4.3)
Hypertension	5 (4.3)
Snake Bite	4(3.4)
Burns	3(2.6)
BMI<18	3(2.6)
Immunosupression	2(1.7)
Hypothyroidism	2(1.7)
Malignancy	1(0.9)
Child Birth	1(0.9)
Others*	13(11.3)
*Others include Chicken pox, COPD, Demyelinating sensorimotor polyneuropathy, Old age (>75), paraplegia, pyelonephritis, steroid and ulcerative colitis	

Figure 3: Risk Factors in percentage



Clinical Features:

General condition:

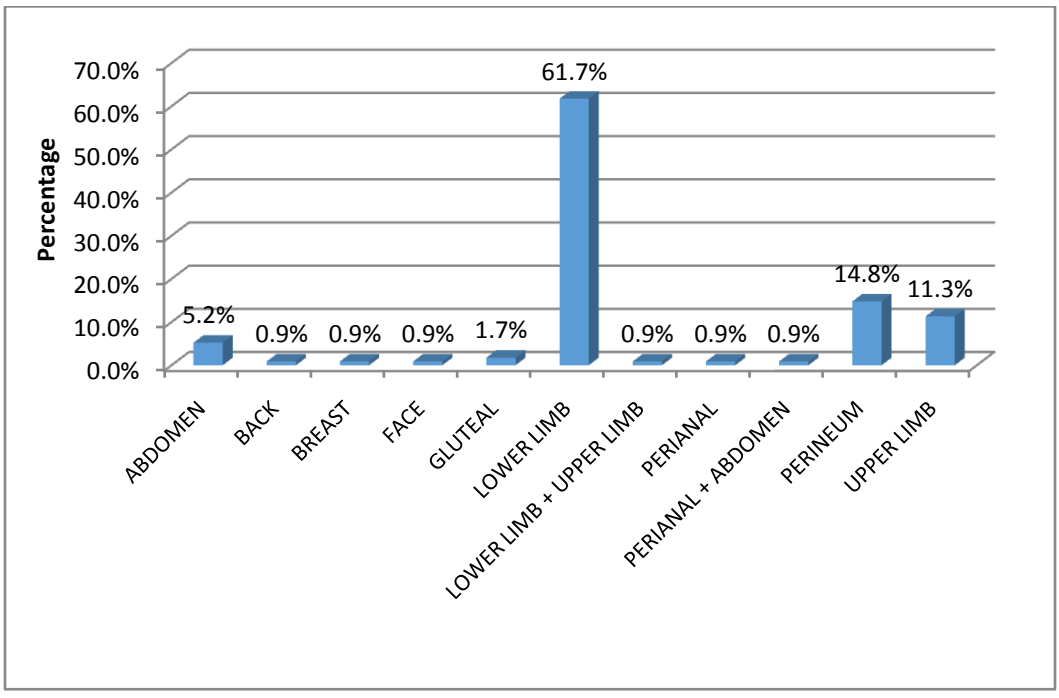
The mean heart rate is 92 beats/minute with most patients presenting with tachycardia. (Range 56-138 beats/minute). Tachypnea was uncommon with a mean respiratory rate of 20/min. Only 3.5% patients (n=4) were febrile on presentation. 7.8% patients (n=9) had altered sensorium. 21.7% (n= 25) patients presented with hypotension and shock (SBP<90). This also demonstrates how patients presenting to our center sought treatment in the early phases of the disease prior to the onset of frank sepsis and septic shock.

Site- The most common site of necrotizing soft tissue infections were the extremities followed by Fournier's gangrene or necrotizing fasciitis of the perineum.

Table 5: Distribution of patients according to Site of Infection

Site	n (%)
Lower limb	71(61.7)
Perineum	17(14.8)
Upper limb	13(11.3)
Abdominal Wall	6(5.2)
Gluteal Region	2(1.7)
Others*	6(5.2)
*Others include Back, Breast, face, both limbs, perianal, perianal region extending intra-abdominally	

Figure 4: Distribution of patients according to Site of Infection

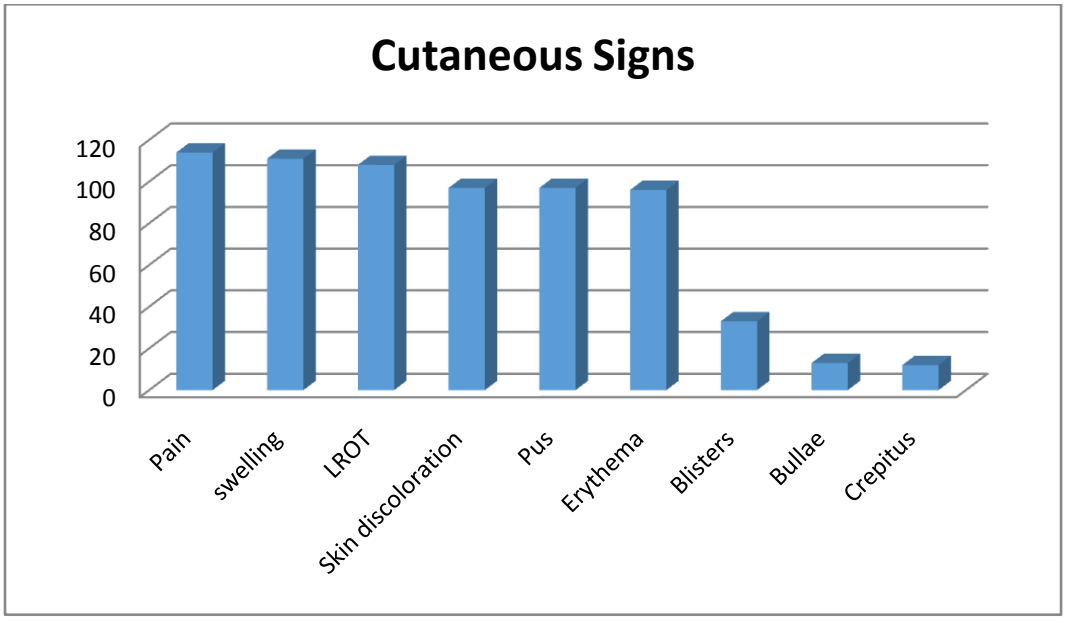


Cutaneous Signs- Most patients presented with cellulitis type picture with pain, swelling and local rise of temperature and demonstrates that patients sought treatment before the onset of late cutaneous signs such as bullae, blisters and the heralding necrotic patch present in the later stages of the disease, i.e. majority of patients presented with Stage 1 necrotizing soft tissue infections.

Table 6: Presence of Cutaneous Signs

Cutaneous Sign	n (%)
Tenderness	114(99.1)
Oedema	111(96.5)
Local rise of temperature	108(93.9)
Skin Discoloration/Necrotic patch	97(84.3)
Dishwater Pus	97(81.7)
Erythema	96(83.5)
Blisters	33(11.3)
Bullae	13(11.3)
Crepitus	12(10.4)

Figure 5: Presence of Cutaneous Signs



Investigations:

Table 7: Blood Investigations

Parameter	Mean	Range	Reference Range
TLC	18	1.8-66	4-11
PLT(x 10^3)	260	26-964	150-450
UREA(mg/dL)	58.6	0.9-231	7-20
CREATININE(mg/dL)	2.2	0.3-3.7	0.6-1.2
ALBUMIN(g/dL)	2.6	0.7-5.6	3.5-5
TOTAL BILIRUBIN(mg/dL)	1.9	0.1-23	0.1-1.2
DIRECT BILIRUBIN(mg/dL)	1.3	0.1-11.4	<0.3
SODIUM(mEq/L)	133.8	122-146	15-145

Treatment:

Initial Resuscitation: All patients admitted with necrotizing soft tissue infections were started on intravenous antibiotics, either penicillin or a third generation cephalosporin with Metronidazole or Clindamycin. Patients were started on IV fluids and if in severe hypotension, on inotropic support and invasive monitoring. Patients with poor GCS and respiratory failure were put on mechanical ventilation as deemed necessary.

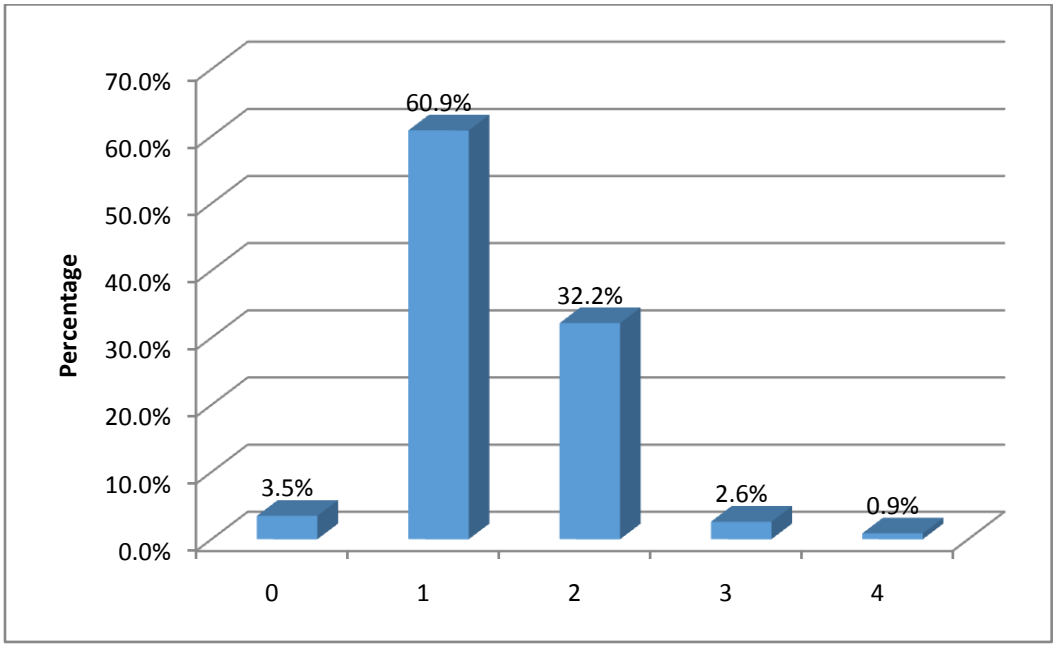
Surgical Debridement:

After initial resuscitation, 111 patients underwent surgical debridement, 4 patients were planned for debridement but expired before the procedure. 70 patients underwent surgical debridement only once (60.9%), 37 patients (32.2%) required redebridement, 3 patients underwent debridement three times (2.6%), one patient underwent debridement four times (0.9%).

Table 8: Surgical Debridements Required

No. of Surgical Debridements required	n (%)
Single	70(60.9)
Twice	37(32.2)
Thrice	3(2.9)
Four times	1(0.9)
Planned	4(3.5)

Figure 6: Number of surgical Debridements required in Percentage



Limb Amputation and diversion stoma:

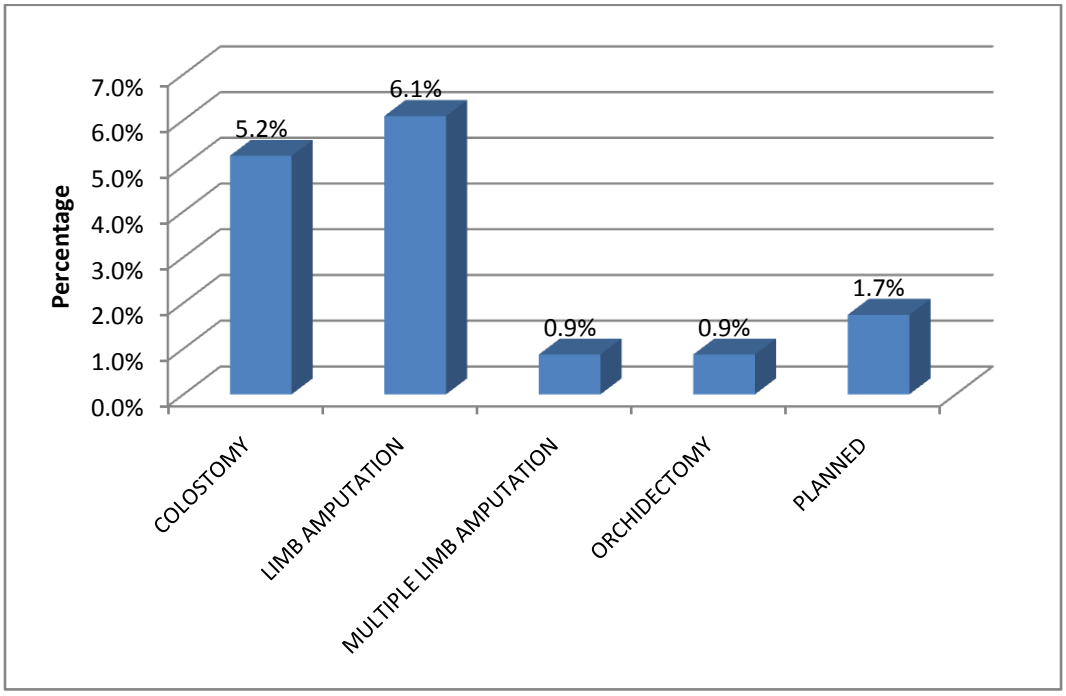
Of patients with NSTI of the extremities, 7 required an amputation of the limb (6.1%) and one patient required multiple limb amputations (0.9%). In patients with Fournier's gangrene one patient (0.9%) required orchidectomy.

In NSTI of the perianal region and Fournier's gangrene, 6 patients (5.2%) required a diverting stoma, usually in the form of sigmoid loop colostomy.

Two patients (1.7%) were planned for a limb amputation but expired before they could undergo the procedure.

Of patients requiring amputation, only relative factors were 62.5% (n=5) were diabetics and 87.5% (n=7) had necrosis of muscle on operative findings.

Figure 7: Patients requiring amputation or diversion surgery in percentage

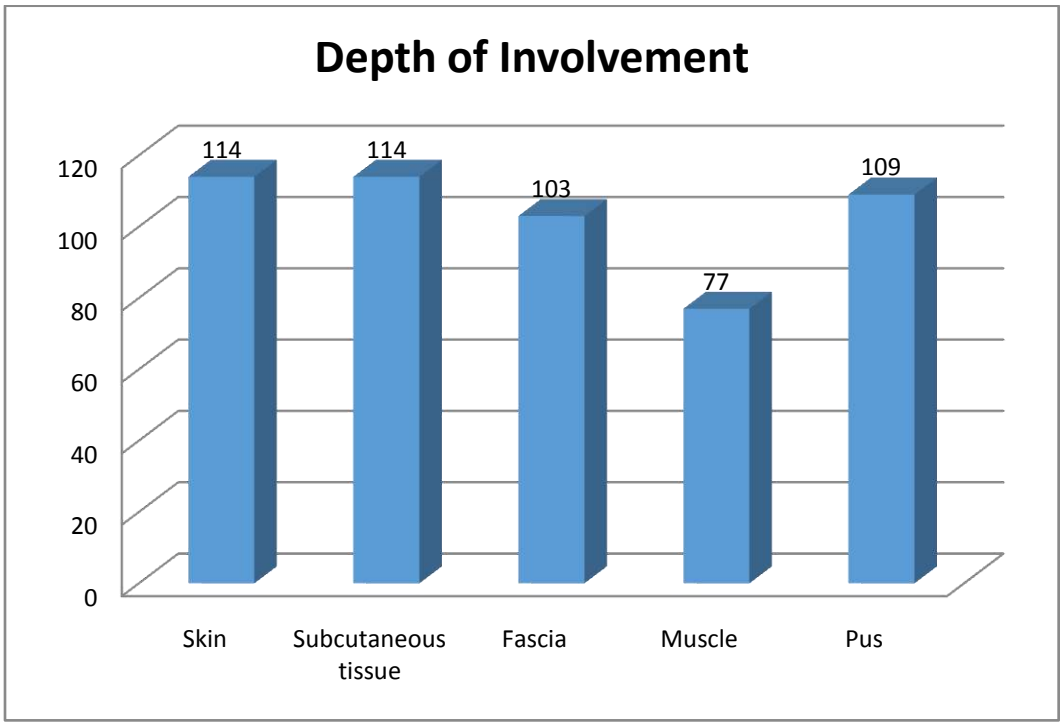


Operative findings- Majority of patients had involvement of subcutaneous tissue, with 9 patients having superficial disease not involving underlying fascia, 89.6% had fascial involvement. 77 patients had myonecrosis as well. 94.8% patients had the characteristic dish water pus.

Table 9: Depth of involvement in Operative findings

Operative finding	n (%)
Skin involvement	114 (99.1)
Subcutaneous tissue involvement	114 (99.1)
Fascial Involvement	103 (89.6)
Myonecrosis	77(67)
Pus	109(94.8)

Figure 8: Depth of Involvement of Infection



Microbiological profile:

Culture samples:

Of the samples we had sent for culture sensitivity,

- 60 of these were samples of infected tissue (52.2%)
- 26 were samples of pus (22.6%)
- 29 were wound swabs of the infected area (25.2%)

The time of retrieval was

- Intra-operatively for 85 patients (73.9%)
- Post-operatively for 19 patients (16.5%)
- Pre-operatively for 11 patients (9.6%)

Figure 9: Type of Culture Sample

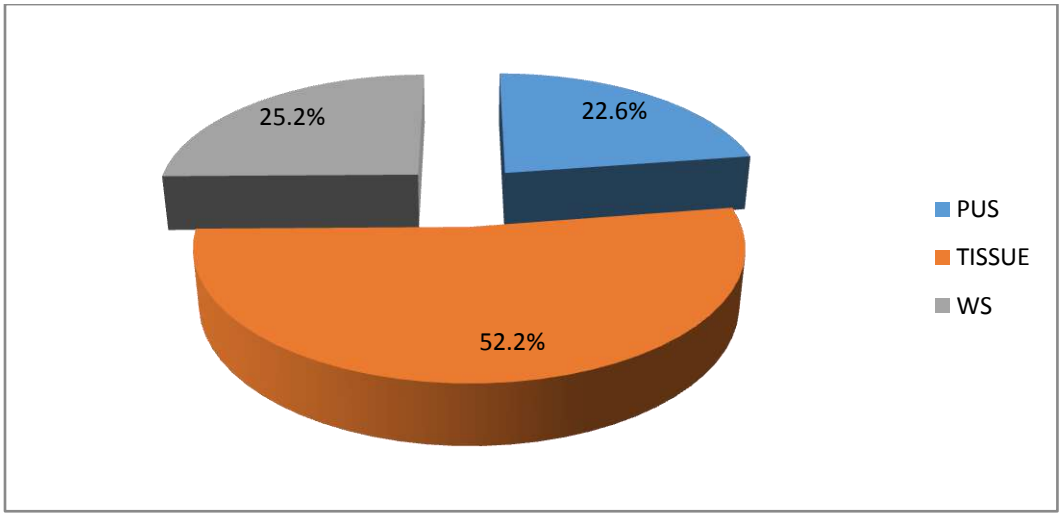
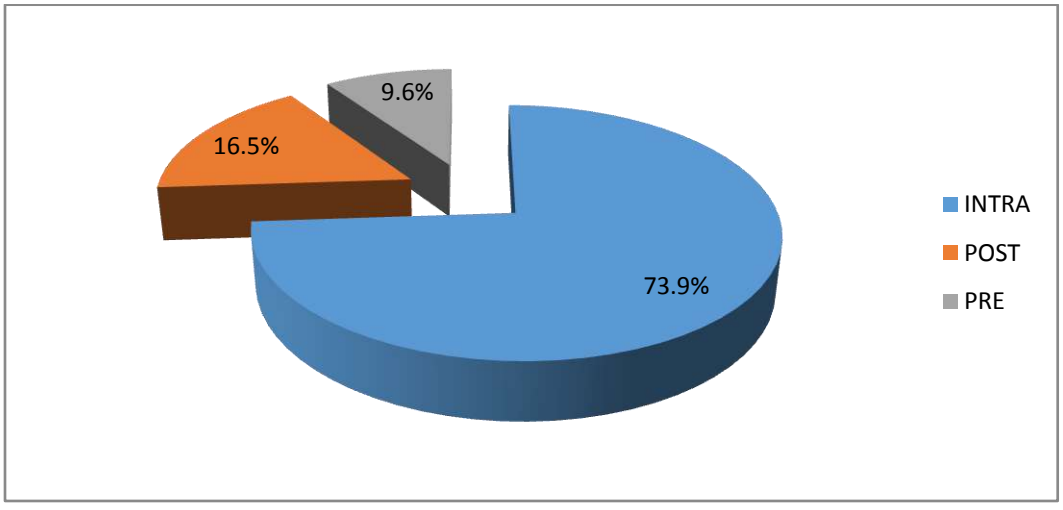


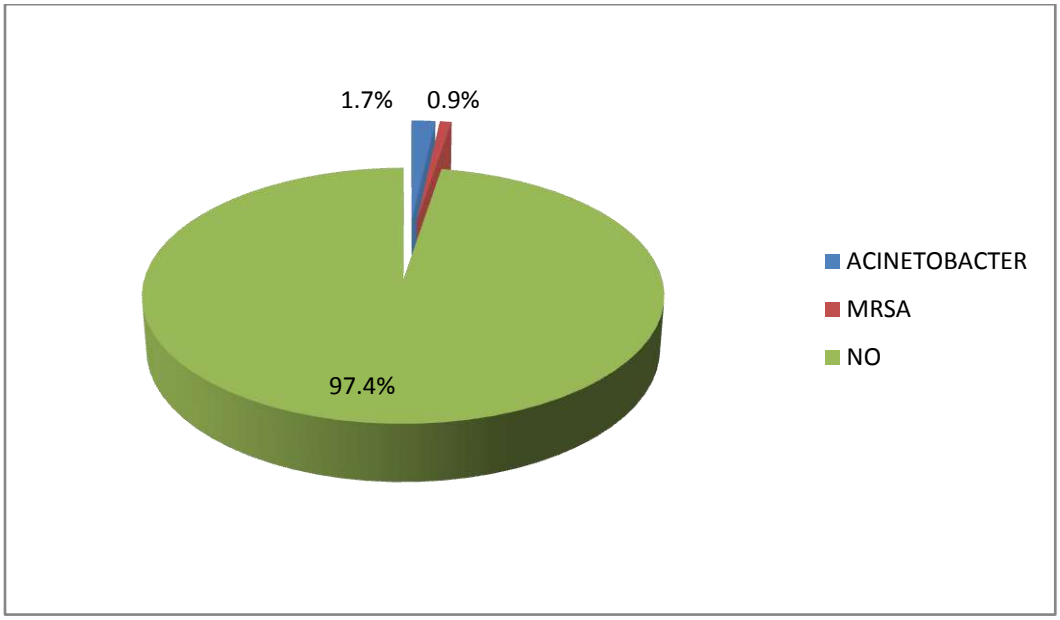
Figure 10: Time of collection of Culture Sample



Blood Culture:

Most patients (112, 97.4%) did not have any growth on blood culture or bacteremia. Of the three patients that did show growth, two showed the growth of Acinetobacter (1.7%) and one showed the growth of Methicillin Resistant Staphylococcus Aureus, MRSA (0.9%).

Figure 11: Blood Culture Results



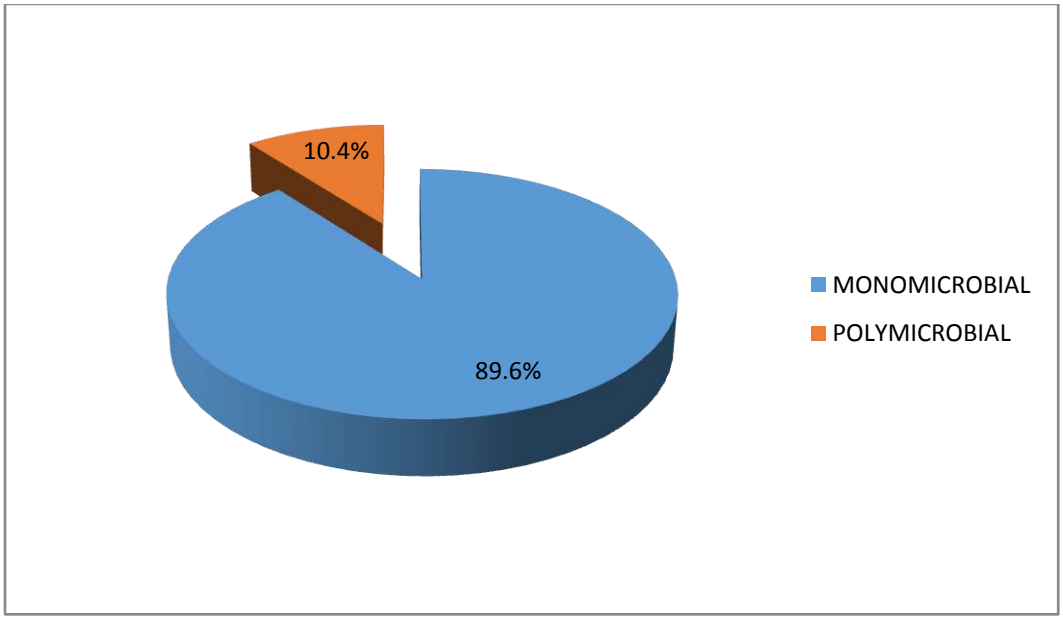
Microbiological profile:

Samples were collected by aseptic techniques and sent for aerobic and fungal culture. The samples were initially grown on MacConkey's agar and Blood Agar. Gram staining was done once a growth was observed. For gram negative growths, MacConkey's agar was used and for gram positive Blood Agar was used for further analysis. Growth was further continued either manually with drug sensitivity checked by Kirby-Bauer method or automated in Vitek 2.

Of the samples sent for 115 patients, 15 showed no growth for two repeat samples. The remaining 100 showed either monomicrobial or polymicrobial growth. Two patients showed fungal hyphae on smear. These were further classified into gram negative and gram positive organisms. Prevalence of each infective organism was calculated and associated with need for intensive care and mortality.

Only 12 patients (10.4%) had polymicrobial growth the rest (103, 89.6%) had monomicrobial growth of bacteria.

Figure 12: Distribution of Polymicrobial and Monomicrobial infections



Prevalence of organisms in polymicrobial infections

Table 10: Distribution of pathogenic organisms in Polymicrobial infections

Organism	No. of cases (12)	percentage
Gram Negative bacteria		
Acinetobacter	8	66.6
E. Coli	3	25
Pseudomonas	5	41.6
Citrobacter	1	8.3
Klebsiella	5	41.6
Providentia	1	8.3
Morganella	1	8.3
Gram positive bacteria		
MSSA	1	8.3
Enterococcus	2	16.6
Fungus		
Fungal hypahe	1	8.3

Monomicrobial Infections:

Table 11: Distribution of Gram Positive Monomicrobial Infections

Organism	No. of cases	Percentage
MRSA	1	0.9%
MSSA	15	13.0%
Staphylococcus Hemolyticus	1.0	0.9%
Enterococcus	1.0	0.9%
Streptococcus	1	0.9%

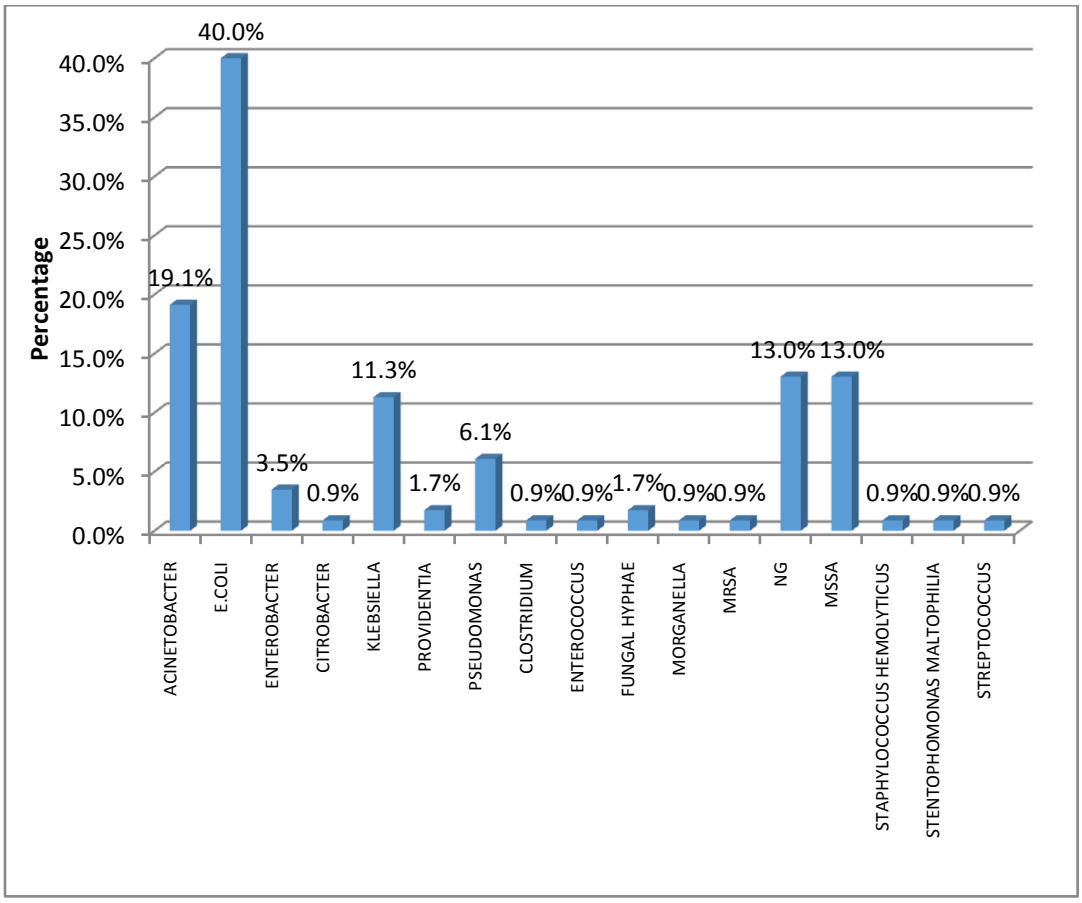
Table 12: Distribution of Gram Negative Monomicrobial Infections

Organism	No. of cases	Percentage
Acinetobacter	22	19.1%
E.Coli	46.0	40.0%
Enterobacter	4.0	3.5%
Citrobacter	1	0.9%
Klebsiella	13	11.3%
Providentia	2	1.7%
Pseudomonas	7	6.1%
Clostridium	1.0	0.9%
Stentophomonas Maltophilia	1.0	0.9%
Morganella	1	0.9%

Table 13: Other Cases

Organism	No. of cases	Percentage
Fungal Hyphae	2	1.7%
No Growth	15	13.0%

Figure 13: Frequency of Bacteria in Monomicrobial Infections



Diabetic Patients- Most common infection was with E.coli followed by Acinetobacter which was comparable to the non-diabetic cases.

Table 14: Distribution of Pathogenic Bacteria in Diabetic Patients

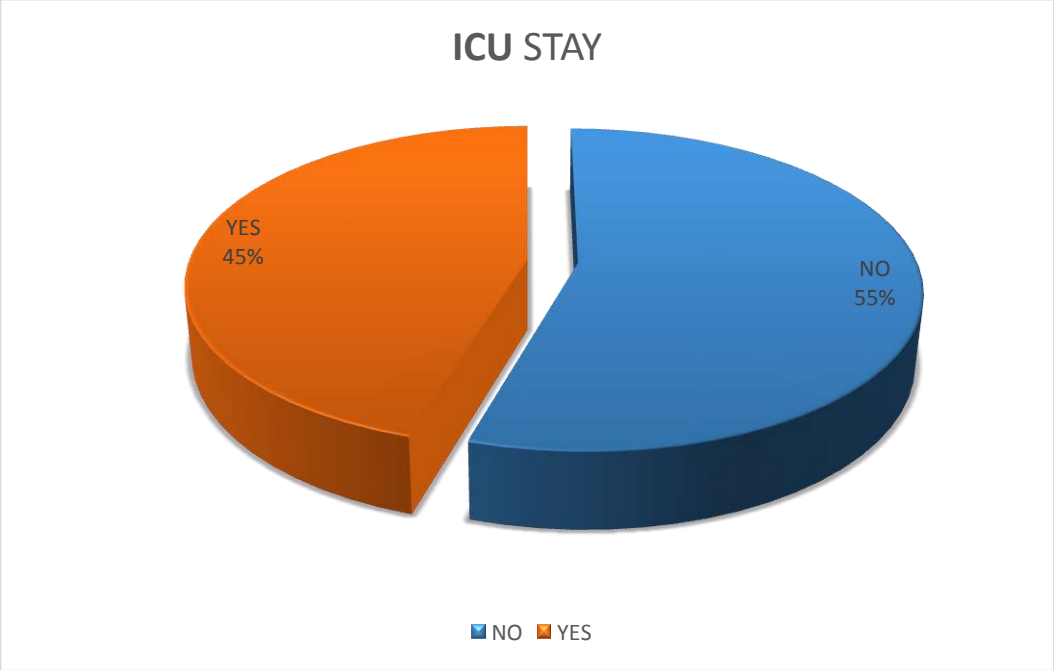
Organism	No. of cases (69)	Percentage
Acinetobacter	15	21.7
E.Coli	29	42.02
Enterobacter	1	1.4
Citrobacter	1	1.4
Klebsiella	10	14.4
Enterococcus	1	1.4
Pseudomonas	4	5.7
Fungal Hyphae	1	1.4
MSSA	9	13
Morganella	1	1.4
Staphylococcus Hemolyticus	1	1.4
Stentophomonas Maltophilia	1	1.4

Factors affecting need for intensive care:

Need for intensive care signifies organ failure, severe disease and the presence of septicemia. All patients with necrotizing soft tissue infections included in our study were classified according to the need for intensive care at any point of disease duration and hospital stay for more than 24 hours. Intensive care is representative of increased morbidity.

The result was that 45.2% of patients (52) required Intensive care where as the remaining 54.8% (63) patients did not.

Figure 14: Need for Intensive care in percentage

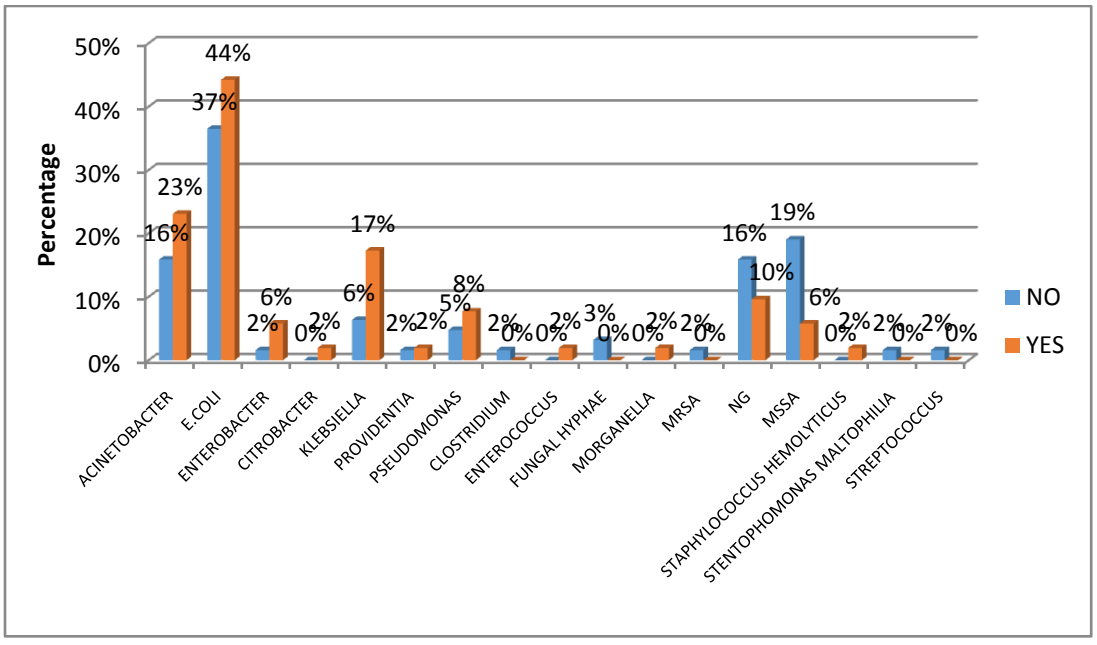


The demographic data, etiology, risk factors, clinical presentation, operative findings, biochemical parameters, growth of cultures were compared to the risk of need for intensive care by Univariate regression analysis and the following results were obtained:

Table 15: Enumeration of Factors influencing Need for Intensive Care

Factors Influencing need for intensive care	**Factors not influencing need for intensive care**
Male gender (p-value= 0.016)	Age of the patient (p-value=0.41)
Decreased urine output (p-value=0.00)	Chronic liver disease (p-value=0.3)
Trauma (p-value = 0.04)	Site Affected (p-value=0.16)
Fever (p-value= 0.02)	Number of debridements (p-value 0.6)
Diabetes (p-value=0.02)	Positive blood culture (p-value=0.5)
Chronic Kidney disease (p-value=0.04)	Polymicrobial growth (p-value=0.11)
Amputation (p-value=0.02)	
Muscle involvement (p-value= 0.005)	
Klebsiella infection (p-value=0.008)	

Figure 15: Distribution of patients according to bacterial infection according to need for intensive care

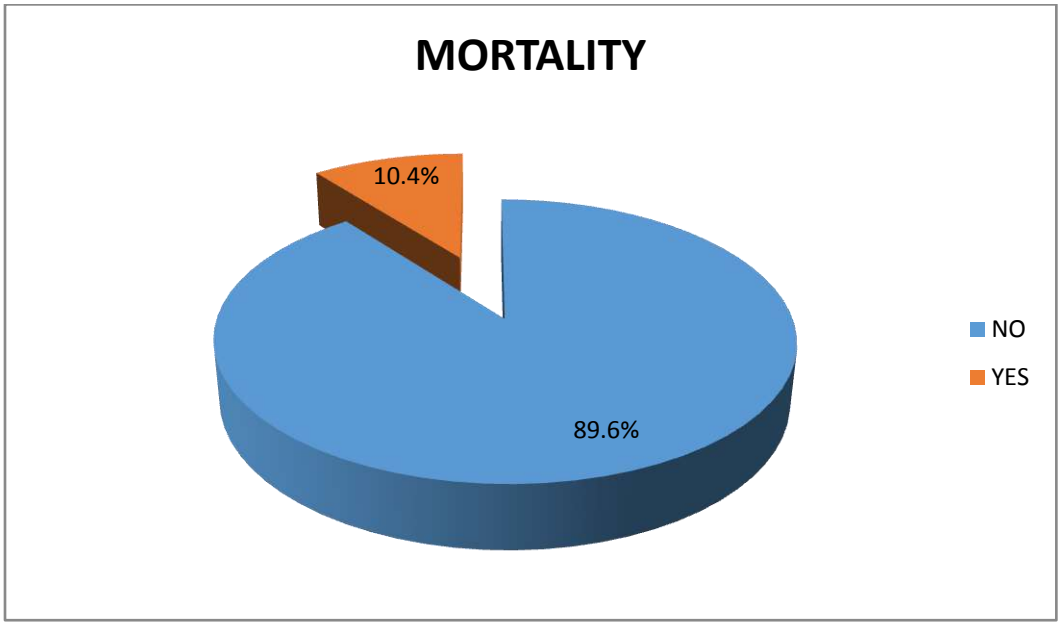


Factors affecting Mortality:

Necrotizing soft tissue infections are known for their rapid spread and risk for being fatal if not treated promptly and adequately with surgical debridement.

In our study, out of 115 patients, 12 patients expired during hospital stay giving a rate of mortality of 10.4%.

Figure 16: Mortality of patients in percentage

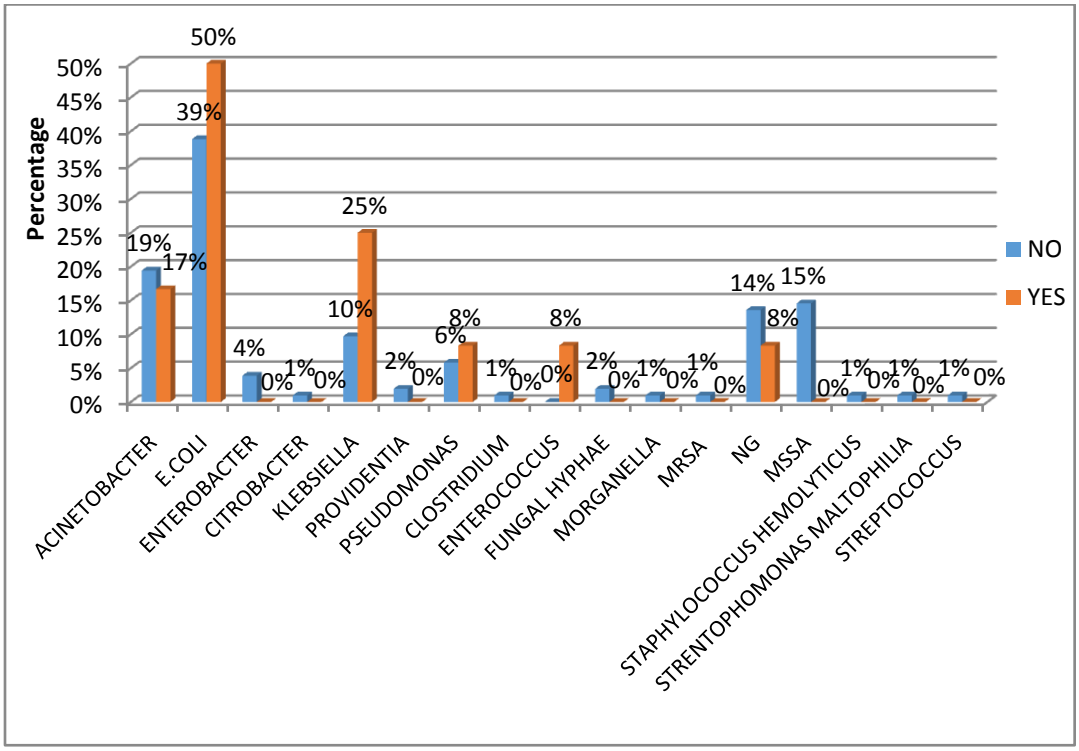


Similar to intensive care, the demographic data, etiology, risk factors, clinical presentation, operative findings, biochemical parameters, growth of cultures were compared to the risk of mortality by univariate regression analysis and the following results were obtained:

Table 16: Enumeration of Factors influencing Mortality

Factors Influencing mortality	Factors not influencing mortality
Fever (p-value=0.05)	Age (p-value = 0.3)
BMI < 18 (p-value=0.02)	Gender (p-value=1)
Blisters (p-value=0.005)	Diabetes (p-value=0.26)
Amputation (p-value=0.003)	Site affected (p-value=0.13)
Acinetobacter infection (p-value=0.05)	No. of debridements (p-value=0.3)
	Blood culture (p-value=0.8)
	Polymicrobial infection (p-value=1)

Figure 17: Mortality of patients according to Bacterial Infection



DISCUSSION

Necrotizing soft tissue infections are a rapidly progressive, potentially fatal illness characterized by necrosis of soft tissue. The disease is highly lethal if untreated and so a clear understanding of the disease entity and the principles of treatment is imperative. The disease may present itself in many ways often leading to difficulty in diagnosis.[10] It may follow trauma or may be insidious and go unnoticed by the patient at first. It may be present with classically associated risk factors such as Diabetes Mellitus[9] or may also occur in otherwise healthy adults. It is known to affect virtually any part of the body despite usually affecting the extremities. Patients on presentation can have a paucity of cutaneous signs[19] or may have the classical skin changes, such as bullae or crepitus, or may present with full blown sepsis and shock. Historically known to be caused by Group A Beta-hemolytic Streptococci,[6] the microbial agent can vary from polymicrobial bacterial synergistic gangrene[15] to monomicrobial gram negative necrotizing fasciitis[8] to Clostridial gas gangrene[14] to fungal infections of soft tissue.[23]

It is this wide plethora of clinical presentations that often makes diagnosis difficult. Moreover, the high risk of mortality that increases with even a delay of 12 hours in life saving debridement makes understanding the disease entity even more significant.[10] Early diagnosis and prompt surgical debridement is the mainstay to a cure.

In this prospective study, which includes 115 patients, we have tried to describe necrotizing soft tissue infections in terms of demographic characteristics, presenting symptoms, risk factors, clinical features, investigations, depth of involvement, type of surgical debridement, biochemical investigations, the microbial pathogen as per growth on culture and their association with morbidity in the form of need for intensive care and mortality.

Here is how our results compare to those of similar descriptive studies done in the past 20 years:

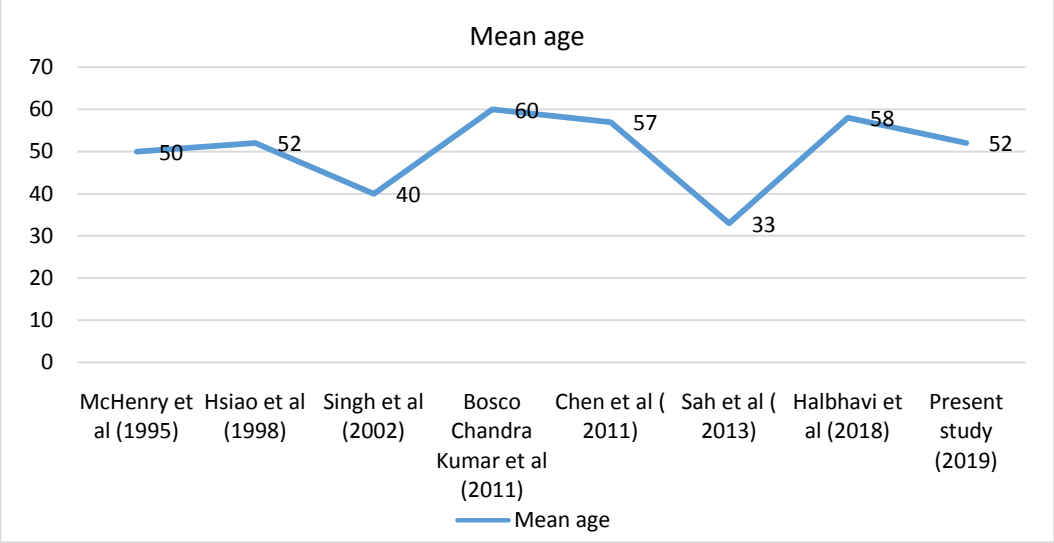
Demographics:

Age- Necrotizing fasciitis is classically known to affect middle aged adult males.[9] Our mean age and a prevalence of male gender is comparable to other studies on necrotizing soft tissue infections. As depicted in table 17 and figure 18, we can see the age distribution of patients affected by the disease has not changed much in the last 20 years or so.

Table 17: Mean Age in Similar Studies

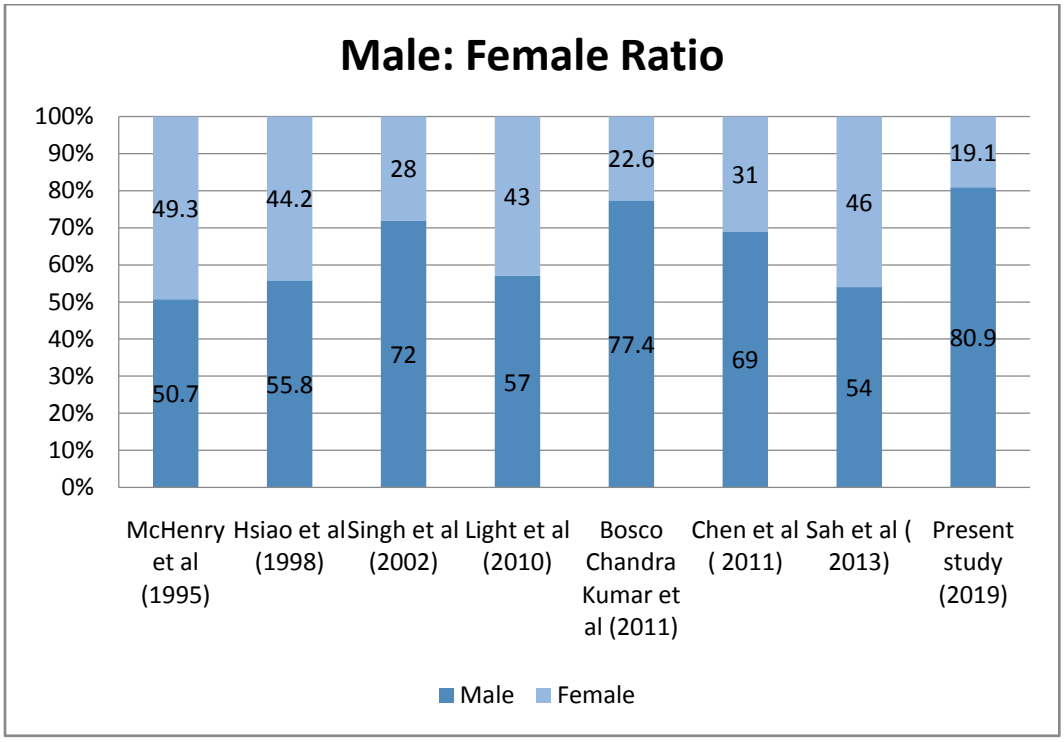
Study	Mean age
McHenry et al (1995)[32]	50
Hsiao et al (1998)[37]	52
Singh et al (2002)[38]	40
Light et al (2010)[39]	49
Bosco Chandra Kumar et al (2011)[40]	60
Chen et al (2011)[22]	57
Sah et al (2013)[41]	33
Halbhavi et al (2018)[42]	58
Present study (2019)	52

Figure 18: Mean Age of patients in similar studies



Sex: Our study showed a high predominance of male patients as opposed to females. In comparison to other similar studies conducted in the past 20 years (figure 19), our male to female ratio is more in favor of male patients and is similar to Bosco Chandra Kumar et al study in 2011 and Singh et al study in 2002 which were also conducted in India.

Figure 19: Sex Distribution in similar studies



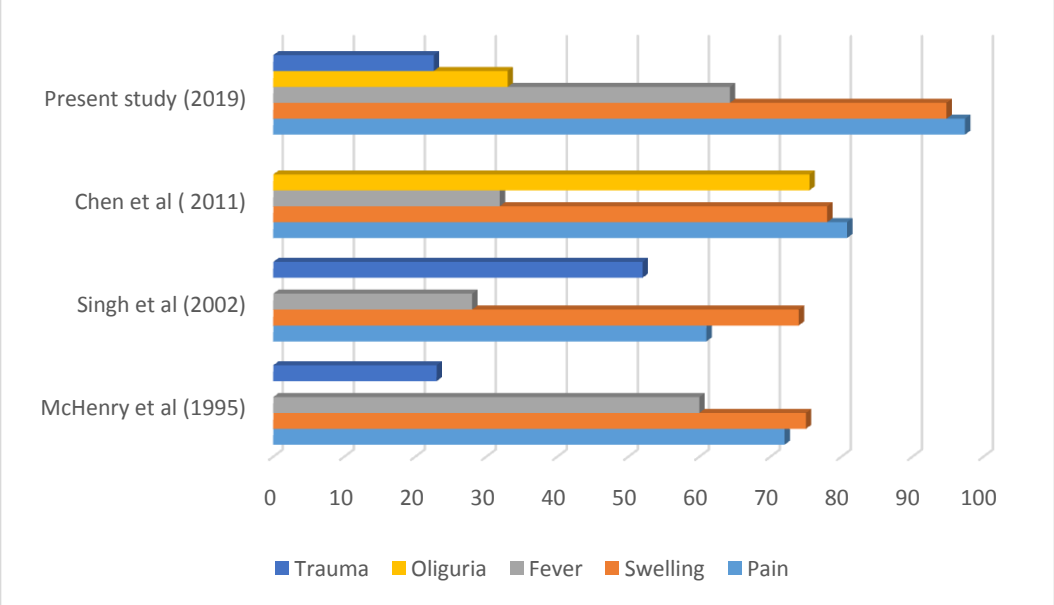
Etiology and Risk factors:

Etiology and Chief Complaints- Majority of our patients presented with the complaints of swelling and pain of the inflicted part in comparison to fever and oliguria. Fever and oliguria are representative of systemic symptoms. This demonstrates that patients presented at the early stage of the disease and most patients sought treatment before the onset of systemic toxicity or severe sepsis. The notion of a trauma, either micro or macro as an inciting factor did not stand true in the case of our patients, where only 22.6 had the history of trauma. Majority of patients the disease was insidious in onset. This is how it compared to other studies:

Table 18: Frequency of Clinical Features in Similar Studies

Study	Pain	Swelling	Fever	Oliguria	Trauma
McHenry et al (1995)[32]	72	75	60		23
Singh et al (2002)[38]	61	74	28		52
Chen et al (2011)[22]	80.8	78	31.9	75.5	
Present study (2019)	97.4	94.8	64.3	33	22.6

Figure 20: Frequency of Clinical Features in Similar Studies



Risk Factors- The most common risk factors in our study were found to be Diabetes, Alcoholism and Cardiac Disease, as depicted in Table 19. While the presence of diabetes (p-value=0.02) and chronic kidney disease (p-value=0.04) were associated with greater morbidity and need for intensive care, A BMI of less than 18 (p-value=0.02) was associated with greater mortality. The presence of diabetes as the most common risk factor has been observed in various studies in the past 20 years (Table 19), with almost all studies showing the prevalence of diabetes of around 50% (Table 20). Other risk factors are variable and may be more keenly associated with other demographic data such as patient's lifestyle (Low or High BMI, Alcoholism).

Table 19: Frequency of Common Risk Factors in Similar Studies

Study	Risk factor 1	Risk factor 2	Risk factor 3
McHenry et al (1995)[32]	Obesity (46.1%)	Diabetes (44.6%)	Hypoalbuminemia (40%)
Hsiao et al (1998)[37]	Diabetes (50%)	CLD (14.7%)	Alcoholism (14.7%)
Singh et al (2002)[38]	Diabetes (29%)	Steroids (2.6%)	Rheumatoid arthritis (1.3%)
Light et al (2010)[39]	Diabetes (56%)	Cardiac Disease (38%)	Smoking (33%)
Chen et al (2011)[22]	Diabetes (60.4%)	Liver disease (28.2%)	Renal disease (18.6%)
Present study (2019)	Diabetes (60%)	Alcoholism (13.9%)	Cardiac Disease (11.3%)

Table 20: Frequency of Diabetes in Similar Studies

Study	Incidence of Diabetes (%)
McHenry et al (1995)[32]	44.6
Hsiao et al (1998)[37]	50
Singh et al (2002)[38]	29
Light et al (2010)[39]	56
Chen et al (2011)[22]	60.4
Present study (2019)	60

Clinical Features:

Site- The most common site affected in our study was the extremities as compared to other sites. This was comparable to other studies as depicted in Table 21.

Table 21: Sites infected in Order of Frequency in Similar Studies

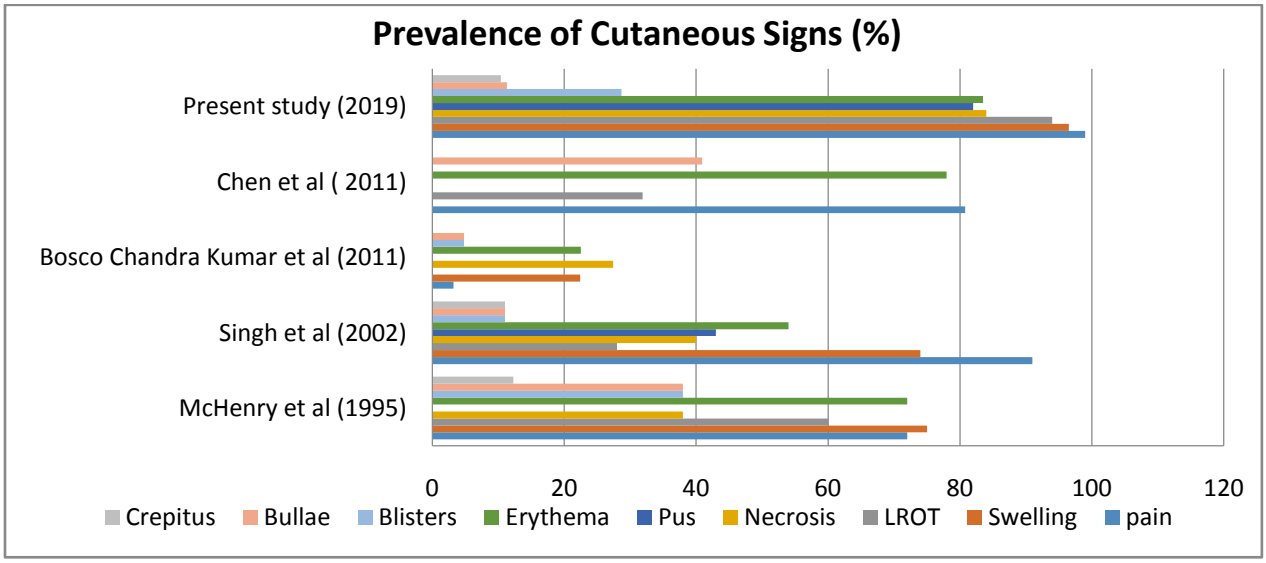
Study	Site Affected 1	Site affected 2	Site Affected 3
McHenry et al (1995)[32]	Trunk (56.9%)	Extremities (40%)	Head and Neck (3.07%)
Hsiao et al (1998)[37]	Extremities (70.5%)	Trunk (17.6%)	Head and neck (23.5%)
Singh et al (2002)[38]	Extremities (53%)	Trunk (35%)	Perineum (28%)
Chen et al (2011)[22]	Extremities (85%)	-	-
Present study (2019)	Extremities (73.9%)	Perineum (14.8%)	Trunk (7%)

Cutaneous signs- The characteristic pathognomonic and heralding signs including crepitus, bullae and necrotic patch were not present in majority of our patients. They presented with tenderness, swelling and erythema. These cutaneous signs are found earlier on as the disease evolves, that is, Stage One Necrotizing Soft tissue infection.[17] They sought treatment and underwent debridement before the onset of the late cutaneous signs and severe sepsis. This is comparable to most other studies as depicted:

Table 22: Frequency of Clinical Signs in Similar Studies

Study	Pain	Swelling	LROT	Necrosis	Pus	Erythema	Blisters	Bullae	Crepitus
McHenry et al (1995)[32]	72	75	60	38		72	38	38	12.3
Singh et al (2002)[38]	91	74	28	40	43	54	11	11	11
Bosco Chandra Kumar et al (2011)[40]	3.2	22.4		27.4		22.5	4.8	4.8	
Chen et al (2011)[22]	80.8		31.9			78		40.9	
Present study (2019)	99	96.5	94	84	82	83.5	28.7	11.3	10.4

Figure 21: Frequency of Cutaneous Signs in Similar Studies



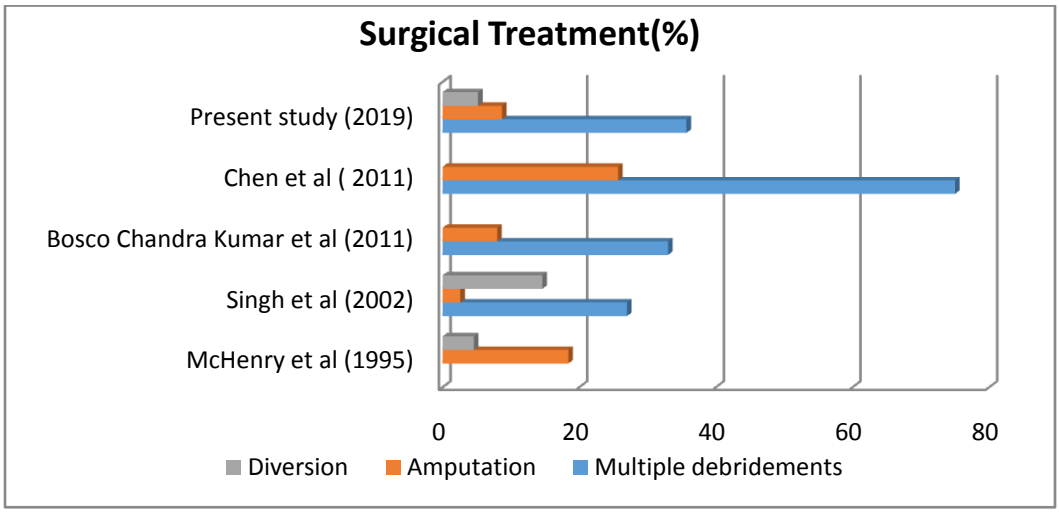
Treatment:

Surgical intervention- The mean number of debridements for our patients was 1.4. The number of patients undergoing multiple debridements and limb amputation was less as compared to other studies as depicted in table 23. This is probably due to the fact that patients presented early on in the illness and had early cutaneous signs as discussed earlier and sought treatment and recovered before the onset of severe sepsis and local spread of disease.

Table 23: Comparison of need for Amputation and Diversion Surgery

Study	Multiple debridements	Amputation	Diversion
McHenry et al (1995)[32]		18.4	4.6
Singh et al (2002)[38]	27	2.6	14.6
Bosco Chandra Kumar et al (2011)[40]	33	8	
Chen et al (2011)[22]	75	25.7	
Present study (2019)	35.7	8.7	5.2

Figure 22: Comparison of need for Amputation and Diversion Surgery



In our study, 67% showed the involvement of muscle which is higher than most studies. Singh et al (2002) showed a muscle involvement of only 21%.[38]

Microbiological Analysis:

Blood Culture- Chen et al in 2011 demonstrated how a positive blood culture had a statistically significant relationship with mortality.[22] Positive blood culture signifies bacteremia and sepsis. In our study, Blood culture was positive in only 2.6% patients which are not very high in comparison to similar studies done in the past as depicted in table 24. This could be due to the early introduction of intravenous antibiotics or again it could be because patients presented early in the disease process.

Most common growth in a blood culture was Acinetobacter baumannii in our study. Most studies showed a predominance of Gram positive septicemia as shown in table 25 as opposed to this.

Table 24: Frequency of positive Blood Culture in Similar Studies

Study	Blood culture positive
McHenry et al (1995)[32]	18.4
Hsiao et al (1998)[37]	20.5
Chen et al (2011)[22]	20.1
Halbhavi et al (2018)[42]	12.5
Present study (2019)	2.6

Table 25: Most common Growth in Blood culture in similar studies

Study	Organism
McHenry et al (1995)[32]	Streptococcus pyogenes
Hsiao et al (1998)[37]	Staphylococcus aureus
Chen et al (2011)[22]	Vibrio
Halbhavi et al (2018)[42]	Staphylococcus aureus
Present study (2019)	Acinetobacter baumannii

Historically, necrotizing soft tissue infections were known to be caused by Group A Beta- Hemolytic Streptococci.[6] This notion has shifted towards that of a polymicrobial synergistic gangrene.[15] Lately, more and more incidences of monomicrobial gram negative necrotizing soft tissue infections are increasing.[8] Lee et al, have demonstrated MRSA as an upcoming cause of necrotizing soft tissue infections.[7] Similarly, our study showed a predominance of monomicrobial growth as opposed to polymicrobial growths. The most common infection was with monomicrobial Gram negative bacteria, E.coli. The most common gram positive growth was Staphylococcus aureus which is similar to other studies as depicted below:

Table 26: Most common microbial growth in similar studies

Study	Polymicrobial	Gram Positive	%	Gram Negative	%	Fungal	%
McHenry et al (1995)[32]	82	Streptococcus	53	Pseudomonas, E.coli	5.2		
Hsiao et al (1998)[37]	30	Staphylococcus aureus	17.6	Klebsiella	29.4		
Singh et al (2002)[38]	79	Staphylococcus Aureus	46	E.coli	32	Aspergillus	8
Bosco Chandra Kumar et al (2011)[40]		Beta hemolytic Streptococci	20	E.coli	20		
Chen et al (2011)[22]	54.8	MSSA	21.4	Vibrio	17.5		
Sah et al (2013)[41]	4.3	Staphylococcus aureus	42.3	E.coli	11.9		
Halbhavi et al (2018)[42]	62.5	Staphylococcus aureus	45.2	Pseudomonas	38.3		
Present study (2019)	10.4	MSSA	13	E. coli	40	fungal	1.7

Mortality:

Untreated necrotizing fasciitis is ultimately fatal.[10] As depicted in table 28, the mortality rate varies from 5-29%. The mortality is also showing a falling trend. The mortality rate in our study was 10.4%. This is probably due to the fact that patients presented with early cutaneous signs before the onset of septicemia as discussed earlier.

The organism who was associated with a greater mortality in a statistically significant way in our study was Acinetobacter baumannii (p-value=0.05) which is comparable to Halbhavi et al (2018).[42]

Table 27: Mortality Rates in similar Studies

Study	Mortality
McHenry et al (1995)[32]	29
Hsiao et al (1998)[37]	26.5
Singh et al (2002)[38]	27
Bosco Chandra Kumar et al (2011)[40]	5
Chen et al (2011)[22]	16.1
Halbhavi et al (2018)[42]	11.3
Present study (2019)	10.4

Factors affecting mortality:

The factors seen to affect mortality in our study were as follows:

- Patients who presented with decreased urine output had a greater chance of mortality as compared to those who did not. (p-value=0.00)
- The only significant risk factor or co-morbidity associated with mortality was a BMI of less than 18. (p-value=0.02)
- Site of the soft tissue infection did not influence mortality in a significant way. (p-value=0.13)
- Presence of blisters was associated with a greater risk of mortality. (p-value=0.005)
- Number of debridements did not influence mortality (p-value =0.3) whereas need for amputation or diversion stoma did increase the risk for mortality. (p- value= 0.003)
- Depth of invasion and positive blood culture did not influence the risk of mortality in this study. (p-value > 0.05)
- Patients with necrotizing soft tissue infections caused by Acinetobacter baumannii had a greater risk of mortality. (p-value= 0.05)
- Presence of polymicrobial or monmicrobial infections did not influence the risk of mortality. (p-value=1)
- Total leucocyte count (above 20,000), serum urea (>85mg/dl) and raised total bilirubin (>3 mg/dl) were more likely to be associated with need for intensive care as well as mortality.

Chen et al, demonstrated a higher risk of mortality in patients with hypotension, heart disease, liver disease, presence of Vibrio species in wound cultures, presence of fungus (Candida) in wound cultures, presence of Group A Beta-hemolytic Streptococci in blood cultures, presence of Aeromonas species in blood cultures and presence of Vibrio species in blood cultures.[22]

Singh et al, showed that only jaundice showed a significant correlation with patient outcome. Elevated blood urea was significantly associated with mortality. Temperatures above 38°C and jaundice also approached levels of significance.[38]

Mc Henry et al showed Shock at presentation was significantly associated with a higher mortality.[32]

SUMMARY AND CONCLUSION

This prospective study was conducted in patients admitted with necrotizing soft tissue infections at Dayanand Medical College and Hospital, Ludhiana during the time period of December 2017 to September 2019. The study included 115 patients who fit into the inclusion criteria.

- We aimed to describe the various clinical presentations of the patients presenting with necrotizing soft tissue infections based upon a preformed proforma, clinical examination, operative findings and growth of cultures in terms of demographic characteristics such as age and gender, chief complaints, etiological factors, presence of risk factors, blood investigations, presence of typical cutaneous signs, depth of infection, the type of surgical treatment required and microbiological profile.
- Patients were followed during the duration of hospitalization. The outcome was determined in the form of need for intensive care signifying organ failure and severe disease and mortality. The various factors, both clinical, biochemical and microbiological were compared for prevalence, risk of intensive care and mortality.
- We have seen that in the patients we have followed the disease occurs in middle aged (46%) male diabetics (60%) who usually present with complaints of swelling and pain usually involving the extremity. Early cutaneous signs were enough for the patient to undergo debridement in our center with few patients presenting with late features such as blisters and bullae for debridement.
- Most patients require a single surgical debridement with depth of involvement till fascia. Mean number of debridements was 1.4. Few required redebridement (29.1%) or amputation (7%).
- Frank septicemia and a positive blood culture was uncommon (2.6%). Monomicrobial infections were more common than polymicrobial infections (89.6%). In polymicrobial infections the

predominant pathogen was gram negative bacteria, Acinetobacter (66%) and gram positive bacteria enterococcus (16.6%). In monomicrobial infections, the predominant gram negative bacteria was E.coli (40%) and gram positive bacteria was Methicillin sensitive Staphylococcus aureus (13%). Fungal infections were uncommon.

- In diabetics, the most common infective organism was E.coli (42%). Necrotizing soft tissue infections with Acinetobacter (p value=0.05) was found to be associated with greater risk of mortality. Infections with Klebsiella (p-value=0.008) were more likely to be associated with need for intensive care.
- Fever, decreased urine output, presence of diabetes mellitus, chronic kidney disease, need for amputation, muscle involvement, Klebsiella pneumoniae infections (p-value=0.08) had a greater risk of morbidity and need for intensive care.
- Decreased urine output, a BMI of less than 18, presence of blisters, need for amputation or diversion surgery, Acinetobacter baumannii infection (p-value=0.05), raised TLC (>20,000), Raised total bilirubin (>3g/dl), and Raised blood urea (>58mg/dl) were associated with increased risk for mortality.

In conclusion, necrotizing soft tissue infections are a rapidly spreading infectious disease that can be fatal if not treated adequately and urgently. A high degree of suspicion is required, as patients do not always present with heralding cutaneous features, as represented by our study. The mainstay of treatment remains surgical debridement and intravenous antibiotics. In the later stages of disease, amputation and multiple debridements along with diversion of fecal stream may be necessary. Monomicrobial gram negative infections can also be common and patient may present with early cutaneous signs. With urgent surgical debridement and early presentation, mortality levels can be as low as 10.4% as in our study.

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Picture 1: Necrotizing fasccitis of gluteal region in a 32 year old woman post medical termination of pregnancy-post operative

Picture 2: Post Fasciotomy showing unhealthy underlying muscle

Picture 3: Necrotizing fasciitis of thigh in a 38 year old female with bronchial asthma on steroids

Picture 4: Necrotizing fasciitis of thigh in a 38 year old female with bronchial asthma on steroids- post debridement

Picture 5: Necrotizing fasciitis in the right lower limb of a 53 year old diabetic man presenting in profound septic shock. Bullae, necrosis and blisters can be seen. Intraoperatively there was widespread necrosis of underlying fascia upto the leg

Picture 6: Necrotizing fasciitis in right lower limb of a 50 year old diabetic 4 days post history of road traffic accident

Picture 7: Necrotizing fasciitis of left foot in a 28 year old healthy male post trauma

Picture 8: Necrotizing fasciitis of the right arm in a 68 year old diabetic patient presenting with septic shock and acute respiratory and renal failure, post fasciotomy outside

Picture 9: Case of Fournier gangrene in a 38 year old diabetic, Paucity of cutaneous signs present

Picture 10: Post Above knee amputation picture of a 53 year old diabetic patient presenting with necrotizing fasciitis of the right leg and septic shock

S. NO	NAME	MRD	AGE	AGE GROUP	SEX	DOA	SWELLING	FEVER	DECREASED URINE OUTPUT	TRAUMA	PAIN	SBP	DBP	PULSE	RR	TEMPERATURE	GCS	BMI>30	DIABETES	GLYCOSYLATED HB	CKD	CLD	ALCOHOLISM	IMMUNO-SUPRESSION	MALIGNANCY	BURNS	TB	H/O SURGERY	H/O CHILD BIRTH	BMI <18	CARDIAC DISEASE	OTHER
1	BKJ	693104	64	51-70	MALE	21/03/2019	YES	YES	NO	NO	YES	150	90	88	20	AF	15	NO	YES	-	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	HYPOTHYROID
2	RL	608163	66	51-70	MALE	25/10/2018	YES	NO	NO	NO	YES	110	70	98	18	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
3	NS	483600	57	51-70	MALE	22/04/2018	YES	NO	NO	NO	YES	180	90	122	16	AF	15	NO	YES	9.9	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	HTN
4	JK	684327	65	51-70	MALE	7/3/2019	YES	YES	NO	NO	YES	130	90	82	20	AF	15	NO	YES	8.1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5	MS	641693	66	51-70	MALE	22/12/2018	YES	YES	NO	NO	YES	110	60	98	20	AF	15	NO	YES	-	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
6	GL	782276	55	51-70	MALE	6/8/2019	YES	YES	NO	YES	YES	100	70	100	20	AF	15	YES	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7	KK	561709	65	51-70	FEMALE	16/08/2018	YES	YES	NO	YES	YES	100	60	84	16	AF	15	NO	YES	13.8	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
8	BS	765585	65	51-70	MALE	6/8/2019	YES	NO	NO	NO	YES	100	60	85	20	AF	15	NO	NO	-	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
9	SD	439679	80	71-90	FEMALE	12/12/2018	YES	YES	NO	NO	YES	110	70	88	16	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
10	MS	772819	65	51-70	MALE	22/07/2019	YES	YES	YES	NO	YES	90	60	138	22	AF	15	NO	NO	-	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO
11	KS	389598	59	51-70	MALE	17/12/2019	YES	NO	NO	YES	YES	200	100	91	22	AF	15	NO	YES	7.4	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
12	S	580484	42	31-50	MALE	8/12/2017	YES	YES	NO	NO	YES	100	60	110	20	AF	15	NO	YES	-	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
13	NK	685975	52	51-70	MALE	10/3/2019	YES	NO	NO	NO	YES	120	80	86	24	AF	15	NO	YES	11.2	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
14	AG	189813	54	51-70	MALE	18/06/2019	YES	YES	NO	NO	YES	120	80	80	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO	NO	CHICKEN POX
15	S	775042	34	31-50	MALE	26/07/2019	NO	NO	NO	NO	YES	100	60	90	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
16	MK	409873	76	71-90	FEMALE	23/12/2017	YES	NO	NO	NO	YES	120	80	84	16	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
17	TC	755813	57	51-70	MALE	26/06/2017	YES	YES	YES	NO	YES	100	60	95	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
18	S	753636	28	18-30	FEMALE	24/6/2019	YES	NO	YES	NO	YES	80	60	104	22	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	SNAKE BITE
19	HS	77816	35	31-50	MALE	30/7/2019	YES	YES	NO	YES	YES	100	60	98	24	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
20	PC	593273	60	51-70	MALE	2/10/2018	YES	YES	NO	NO	YES	140	90	110	20	AF	15	NO	YES	14.1	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO
21	BK	424327	40	31-50	FEMALE	19/01/2018	YES	YES	YES	NO	YES	80	40	104	20	AF	15	NO	NO	-	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	STEROID
22	V	512291	35	31-50	FEMALE	18/10/2018	YES	YES	NO	NO	YES	120	80	84	20	AF	15	NO	YES	-	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	HCV
23	BS	596000	48	31-50	MALE	6/10/2018	YES	YES	NO	NO	YES	80	50	94	2	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO
24	GS	407356	50	31-50	MALE	19/12/2017	NO	NO	NO	YES	YES	126	80	86	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	Y	NO	NO
25	RS	774333	34	31-50	MALE	21/7/2019	YES	YES	NO	NO	YES	110	70	90	16	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
26	L	721448	63	51-70	MALE	2/5/2019	NO	YES	YES	NO	NO	80	60	120	24	AF	14	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	Y	NO	PARAPLEGIA
27	BS	707989	62	51-70	MALE	11/4/2019	YES	NO	NO	NO	YES	110	70	80	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
28	HK	43936	50	31-50	FEMALE	1/4/2019	NO	YES	YES	NO	NO	100	80	80	20	AF	15	NO	NO	-	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	Y	YES	ULCERATIVE COLITIS
29	RS	722248	50	31-50	MALE	18/05/2019	YES	YES	NO	NO	YES	110	70	80	20	F	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
30	SK	722534	53	51-70	MALE	9/5/2019	YES	NO	NO	NO	YES	120	70	80	20	AF	15	NO	YES	-	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
31	KK	709571	35	31-50	FEMALE	15/04/2019	YES	YES	NO	NO	YES	80	50	120	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO
32	R	720451	45	31-50	MALE	10/5/2019	YES	NO	NO	NO	YES	110	70	80	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
33	PS	716674	70	51-70	MALE	26/04/2019	YES	NO	NO	NO	YES	100	60	78	20	AF	15	NO	YES	-	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
34	DS	779186	75	71-90	MALE	31/07/2019	YES	YES	YES	NO	YES	80	50	110	24	AF	DROWSY	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
35	S	622823	43	31-50	MALE	25/11/2019	YES	NO	NO	NO	YES	110	70	94	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
36	SS	533633	72	71-90	MALE	30/06/2019	YES	YES	YES	YES	YES	60	UR	120	24	AF	9	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
37	AS	775812	20	18-30	MALE	26/07/2019	YES	YES	YES	YES	YES	UR	UR	120	24	F	15	NO	NO	-	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
38	KS	640417	65	51-70	MALE	19/12/2018	YES	NO	NO	NO	YES	100	60	98	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
39	PK	781253	50	31-50	MALE	20/06/2019	YES	YES	YES	NO	YES	100	60	99	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	SNAKE BITE
40	BK	670940	48	31-50	FEMALE	17/07/2019	YES	YES	NO	NO	YES	120	70	90	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
41	G	779689	24	18-30	MALE	1/8/2019	YES	NO	NO	YES	YES	110	70	100	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
42	A	309616	35	31-50	MALE	18/12/2017	YES	YES	YES	NO	YES	110	70	88	20	AF	15	YES	YES	-	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	PYELONEPHRITIS
43	S	753617	55	51-70	FEMALE	23/06/2019	NO	NO	NO	NO	YES	90	60	104	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
44	HS	397714	50	31-50	MALE	1/12/2017	YES	NO	NO	NO	YES	100	60	94	24	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
45	AK	561354	50	31-50	FEMALE	6/8/2018	YES	YES	NO	NO	YES	130	80	56	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
46	HS	441130	28	18-30	MALE	16/02/2018	YES	NO	NO	NO	YES	110	70	88	22	AF	15	NO	NO	-	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
47	PKB	706789	50	31-50	MALE	10/5/2019	YES	YES	NO	NO	YES	120	70	82	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	DEMYELINATING SENSORIMOTOR POLYNEUROPATHY
48	NS	348218	70	51-70	MALE	13/12/2017	YES	YES	NO	NO	YES	80	UR	120	22	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
49	PS	424948	32	31-50	MALE	20/01/2018	YES	NO	NO	NO	YES	120	80	100	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
50	KS	389598	59	51-70	MALE	1/12/2017	YES	NO	NO	YES	YES	200	100	91	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
51	VK	468038	45	31-50	MALE	23/03/2018	YES	YES	NO	NO	YES	110	80	98	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
52	LD	575450	55	51-70	FEMALE	5/9/2018	YES	YES	NO	NO	YES	120	80	80	24	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
53	TS	54434	44	31-50	MALE	13/06/2018	YES	NO	NO	YES	YES	140	90	86	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
54	PS	555511	56	51-70	MALE	13/04/2019	YES	NO	NO	YES	YES	140	90	88	24	AF	15	NO	NO	-	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	HCV
55	R	747820	50	31-50	FEMALE	13/06/2019	YES	YES	NO	NO	YES	110	60	80	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
56	PG	746617	68	51-70	MALE	18/06/2019	YES	YES	NO	NO	YES	110	70	80	20	AF	15	NO	YES	-	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
57	BL	785257	62	51-70	MALE	10/8/2019	YES	YES	YES	NO	YES	60	40	130	30	AF	9	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
58	MK	767008	65	51-70	FEMALE	1/8/2019	YES	NO	YES	NO	YES	90	60	80	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
59	HS	657227	36	31-50	MALE	21/01/2019	YES	NO	NO	NO	YES	120	70	84	20	AF	15	NO	NO	-	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
60	HS	414222	55	51-70	MALE	1/1/2018	YES	NO	NO	NO	YES	100	160	92	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO

S. NO	NAME	MRD	SITE	PAIN	LROT	SKIN DISCOLORATION	SWELLING	ERYTHEMA	BLISTERS	BULLAE	CREPITUS	PUS	NO OF DEBRIDEMENTS	AMPUTATION	SKIN	SUBCUTANEOUS	FASCIA	MUSCLE	PUS	TLC	INR	PLT	UREA	CREATININE	ALBUMN	TOTAL BILIRUBIN	DIRECT BILIRUBIN	SODIUM	BLOOD C/S	CULTURE TYPE
1	BKJ	693104	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	N	1	NO AMPUTATION	YES	YES	YES	NO	YES	20.6	1.2	321	32	0.8	2	-	-	137	NO	TISSUE
2	RL	608163	UPPER LIMB	YES	YES	YES	YES	YES	N	N	N	N	1	NO AMPUTATION	YES	YES	YES	NO	YES	10.4	1.18	573	17	0.6	3	0.3	0.15	133	NO	TISSUE
3	NS	483600	SCROTUM	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	NO	YES	11.7	1.35	216	17	1.07	-	-	-	138	NO	WS
4	JK	684327	SCROTUM	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	NO	NO	YES	11.2	1.2	399	32	1.06	3.8	0.4	0.05	139	NO	TISSUE
5	MS	641693	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	26.8	1.2	292	218	4.9	2.4	2.03	1.9	135	NO	TISSUE
6	GL	782276	LOWER LIMB	YES	YES	YES	YES	YES	Y	Y	Y	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	15.3	1.2	395	102	3.4	3.02	2.09	1.7	125	NO	TISSUE
7	KK	561709	UPPER LIMB	YES	YES	YES	YES	NO	Y	N	N	N	3	LIMB AMPUTATION	YES	YES	YES	YES	YES	27.6	1.3	266	126	2.16	-	-	-	128	NO	TISSUE
8	BS	765585	LOWER LIMB	YES	YES	YES	NO	NO	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	13.7	1.3	663	131	4.4	-	-	-	134	NO	TISSUE
9	SD	439679	LOWER LIMB	YES	YES	NO	YES	YES	Y	N	N	N	1	NO AMPUTATION	YES	YES	YES	NO	YES	36.5	1.3	4	64	1.38	2.2	0.8	0.6	131	NO	PUS
10	MS	772819	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	8.2	1.2	146	102	3.4	3	2.09	1.7	129	NO	PUS
11	KS	389598	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	14.4	1.12	242	30	0.7	2.7	0.3	0.15	129	NO	TISSUE
12	S	580484	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	3.6	1.47	132	15	0.5	2.5	0.6	0.2	130	NO	TISSUE
13	NK	685975	SCROTUM	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	14.3	1.2	285	-	-	-	-	-	132	NO	TISSUE
14	AG	189813	LOWER LIMB	YES	YES	YES	YES	YES	N	N	Y	Y	2	NO AMPUTATION	YES	YES	YES	NO	YES	24	1.1	421	20	0.9	2.8	0.8	0.5	135	NO	TISSUE
15	S	775042	UPPER LIMB	YES	YES	NO	YES	YES	N	Y	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	22.5	11.3	110	27	0.6	1.9	4.02	3.7	133	NO	TISSUE
16	MK	409873	UPPER LIMB	YES	YES	NO	YES	YES	Y	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	43	1.2	295	54	1.17	2.7	0.6	0.2	139	NO	PUS
17	TC	755813	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	9.2	1.5	788	24	1.9	1.2	-	-	139	ACINETOBACTER	TISSUE
18	S	753636	LOWER LIMB	YES	YES	YES	YES	NO	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	27.4	0.99	12	110	4.7	2.3	1.4	0.6	137	NO	WS
19	HS	77816	LOWER LIMB	YES	YES	YES	YES	YES	N	N	Y	N	2	NO AMPUTATION	YES	YES	YES	YES	YES	11.1	1.12	150	42	0.9	2.5	0.6	0.06	134	NO	WS
20	PC	593273	SCROTUM	YES	NO	YES	YES	YES	N	N	N	Y	3	COLOSTOMY	YES	YES	YES	YES	YES	13.8	1.07	301	37	0.92	5.6	-	-	145	NO	PUS
21	BK	424327	LOWER LIMB	YES	YES	YES	YES	YES	N	N	Y	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	15	1.14	220	72	1.9	2.2	3.4	2.9	141	NO	TISSUE
22	V	512291	LOWER LIMB	YES	NO	YES	NO	NO	N	N	Y	N	1	NO AMPUTATION	YES	YES	YES	YES	YES	16.5	1.8	40	92	1.2	2.9	10.3	8.4	126	NO	TISSUE
23	BS	596000	LOWER LIMB	YES	NO	YES	YES	YES	N	N	N	N	4	NO AMPUTATION	YES	YES	YES	YES	YES	34.4	1.15	469	23	0.45	1.6	-	-	125	NO	WS
24	GS	407356	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	N	Y	0	NO AMPUTATION	YES	YES	YES	YES	YES	24	1.1	120	50	2	2	-	-	127	NO	TISSUE
25	RS	774333	ABDOMEN	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	NO	NO	19.3	1.6	287	26	0.5	3	0.6	0.19	142	NO	TISSUE
26	L	721448	GLUTEAL	NO	YES	YES	NO	NO	N	N	N	Y	2	COLOSTOMY	YES	YES	YES	YES	YES	5.6	1.3	132	25	0.6	1.83	0.4	0.2	132	NO	PUS
27	BS	707989	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	19.4	1.5	176	192	3.2	-	-	-	144	NO	TISSUE
28	HK	43936	ABDOMEN	YES	YES	YES	YES	YES	N	N	Y	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	9.4	0.99	376	74	2.1	3.4	0.2	0.09	131	NO	WS
29	RS	722248	BACK	YES	YES	NO	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	20.4	1.3	444	42	0.9	2.2	0.3	0.2	131	NO	PUS
30	SK	722534	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	5.6	1.2	355	22	0.5	1.6	0.5	0.3	135	NO	TISSUE
31	KK	709571	GLUTEAL	YES	YES	YES	YES	YES	N	N	N	N	2	NO AMPUTATION	YES	YES	YES	YES	YES	27.8	1.3	194	45	0.6	3.3	8.2	6.6	133	NO	TISSUE
32	R	720451	SCROTUM	YES	YES	YES	YES	YES	N	N	N	N	1	NO AMPUTATION	YES	YES	YES	NO	NO	10.4	1.5	456	24	0.6	-	-	-	139	NO	TISSUE
33	PS	716674	SCROTUM	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	4	1.5	307	39	1.2	-	-	-	128	NO	TISSUE
34	DS	779186	LOWER LIMB	YES	YES	YES	YES	YES	Y	Y	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	30.7	1.3	262	110	2.7	3.19	1.2	0.7	139	NO	WS
35	S	622823	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	2	LIMB AMPUTATION	YES	YES	YES	YES	YES	12.8	1.3	738	20	0.7	2.2	0.3	0.13	137	NO	TISSUE
36	SS	533633	UPPER LIMB	YES	YES	YES	YES	YES	Y	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	20.1	2.1	156	147	4.2	1.7	0.5	0.14	127	NO	TISSUE
37	AS	775812	LOWER LIMB	YES	YES	YES	YES	YES	N	N	Y	N	1	PLANNED	YES	YES	YES	YES	YES	2.7	1.4	150	118	2.9	-	-	-	129	NO	WS
38	KS	640417	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	6.1	1.5	423	20	0.5	2	-	-	138	NO	WS
39	PK	781253	UPPER LIMB	YES	YES	YES	YES	YES	N	N	N	N	1	NO AMPUTATION	YES	YES	YES	YES	NO	53.4	1.7	22	55	2	4	1.7	0.4	137	NO	TISSUE
40	BK	670940	LOWER LIMB	YES	YES	YES	YES	YES	N	Y	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	1.8	1.4	648	20	0.6	-	-	-	139	NO	TISSUE
41	G	779689	LOWER LIMB	YES	YES	NO	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	11.1	1.1	400	18	0.7	4.1	0.35	0.05	141	NO	PUS
42	A	309616	SCROTUM	YES	YES	YES	YES	YES	N	N	N	Y	2	COLOSTOMY	YES	YES	YES	YES	YES	20	1.3	245	23	0.8	3.5	0.7	0.5	137	NO	TISSUE
43	S	753617	PERIANAL	YES	YES	NO	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	NO	NO	YES	42.4	1.5	240	22	0.7	2.08	1.16	0.7	140	NO	PUS
44	HS	397714	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	N	2	NO AMPUTATION	YES	YES	YES	NO	YES	31.3	1.6	96	63	0.8	2.4	1.5	1.1	126	NO	PUS
45	AK	561354	ABDOMEN	YES	YES	NO	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	12	1.2	98	26	0.9	-	-	-	130	NO	WS
46	HS	441130	UPPER LIMB	YES	YES	YES	YES	NO	N	N	N	Y	1	LIMB AMPUTATION	YES	YES	YES	YES	YES	13.8	1.11	562	26	0.6	3.7	0.3	0.05	141	NO	TISSUE
47	PKB	706789	SCROTUM	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	14.5	1.2	303	23	0.76	3.82	0.48	0.16	140	NO	TISSUE
48	NS	348218	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	18.9	1.7	223	127	15.9	-	-	-	127	NO	TISSUE
49	PS	424948	LOWER LIMB	YES	YES	YES	YES	YES	Y	Y	Y	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	36.1	1.3	463	33	0.5	2.8	0.5	0.3	129	NO	TISSUE
50	KS	389598	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	NO	YES	14.4	1.12	242	30	0.7	3.4	0.3	0.15	129	NO	TISSUE
51	VK	468038	SCROTUM	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	NO	NO	YES	14.1	1.2	250	44	0.85	2.5	0.5	0.1	133	NO	PUS
52	LD	575450	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	13.5	1.2	208	26	0.5	2.9	0.6	0.3	125	NO	PUS
53	TS	54434	UPPER LIMB	YES	YES	YES	YES	NO	N	N	N	N	1	NO AMPUTATION	N	N	NO	NO	YES	16.8	-	210	76	0.4	-	-	-	139	NO	TISSUE
54	PS	555511	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	4.4	1.4	92	0.9	37	3.2	23	0.8	135	NO	TISSUE
55	R	747820	BREAST	YES	YES	YES	YES	YES	Y	Y	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	11.1	1.2	134	156	2.2	2.8	1.09	0.95	141	NO	WS
56	PG	746617	SCROTUM	YES	YES	YES	YES	YES	N	N	N	Y	1	ORCHIDECTOMY	YES	YES	YES	YES	YES	20	1.5	192	50	0.6	2.02	1.2	0.6	123	MRSA	WS
57	BL	785257	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	28.5	1.9	30	84	3.93	1.6	2.3	1.3	129	NO	PUS
58	MK	767008	UPPER LIMB	YES	YES	YES	YES	YES	Y	Y	N	N	0	NO AMPUTATION	YES	YES	YES	YES	YES	18.9	2.5	306	89	2.2	2	-	-	128	NO	TISSUE
59	HS	657227	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	N	Y	2	NO AMPUTATION	YES	YES	YES	NO	YES	6.4	1.8	180	27	0.7	2.8	3.49	1.5	132	NO	TISSUE
60	HS	414222	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	0	MULTIPLE LIMB AMPUTATION	YES	YES	YES	YES	YES	20.7	1.14	545	26	1.07	1.6	0.6	-	135	NO	TISSUE

S. NO	NAME	MRD	TIME	ACINETOBACTER	E.COLI	ENTEROBACTER	CITROBACTER	KLEBSIELLA	PROVIDENTIA	PSEUDOMONAS	CLOSTRIDIUM	ENTEROCOCCUS	FUNGAL HYPHAE	MORGANELLA	MRSA	NG	MSSA	STAPHYLOCOCCUS HEMOLYTICUS	STENTOPHOMONAS MALTOPHILIA	STREPTOCOCCUS	POLYMICROBIAL	ICU STAY	MORTALITY
1	BKJ	693104	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
2	RL	608163	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3	NS	483600	POST	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
4	JK	684327	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5	MS	641693	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
6	GL	782276	INTRA	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
7	KK	561709	INTRA	YES	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
8	BS	765585	INTRA	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
9	SD	439679	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
10	MS	772819	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO
11	KS	389598	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
12	S	580484	INTRA	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
13	NK	685975	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
14	AG	189813	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
15	S	775042	INTRA	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
16	MK	409873	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
17	TC	755813	INTRA	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
18	S	753636	POST	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
19	HS	77816	POST	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
20	PC	593273	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO
21	BK	424327	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO
22	V	512291	INTRA	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
23	BS	596000	POST	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
24	GS	407356	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
25	RS	774333	INTRA	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
26	L	721448	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
27	BS	707989	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
28	HK	43936	PRE	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
29	RS	722248	PRE	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
30	SK	722534	INTRA	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
31	KK	709571	INTRA	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
32	R	720451	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
33	PS	716674	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
34	DS	779186	POST	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
35	S	622823	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
36	SS	533633	INTRA	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
37	AS	775812	PRE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	YES
38	KS	640417	POST	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
39	PK	781253	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO
40	BK	670940	POST	NO	NO	NO	NO	YES	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
41	G	779689	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
42	A	309616	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
43	S	753617	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
44	HS	397714	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
45	AK	561354	POST	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
46	HS	441130	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
47	PKB	706789	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
48	NS	348218	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
49	PS	424948	INTRA	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
50	KS	389598	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
51	VK	468038	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
52	LD	575450	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
53	TS	54434	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
54	PS	555511	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
55	R	747820	POST	YES	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
56	PG	746617	POST	YES	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
57	BL	785257	INTRA	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
58	MK	767008	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
59	HS	657227	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
60	HS	414222	INTRA	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

S. NO	NAME	MRD	AGE	AGE GROUP	SEX	DOA	SWELLING	FEVER	DECREASED URINE OUTPUT	TRAUMA	PAIN	SBP	DBP	PULSE	RR	TEMPERATURE	GCS	BMI>30	DIABETES	GLYCOSYLATED HB	CKD	CLD	ALCOHOLISM	IMMUNO-SUPRESSION	MALIGNANCY	BURNS	TB	H/O SURGERY	H/O CHILD BIRTH	BMI <18	CARDIAC DISEASE	OTHER
61	DS	347337	25	18-30	MALE	12/12/2017	YES	NO	NO	NO	YES	110	170	80	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
62	HK	397148	65	51-70	FEMALE	1/12/2017	YES	NO	NO	YES	YES	120	70	108	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
63	JR	784535	70	51-70	MALE	18/08/2019	YES	NO	YES	NO	YES	90	160	120	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
64	MS	785931	55	51-70	MALE	10/8/2019	YES	YES	YES	NO	YES	100	60	110	20	AF	15	NO	YES	-	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
65	SS	373207	86	71-90	MALE	1/1/2019	YES	YES	YES	YES	YES	130	80	80	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	OLD AGE
66	KM	78543	58	51-70	FEMALE	13/04/2019	YES	NO	NO	YES	YES	120	80	80	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
67	HS	513906	36	31-50	MALE	5/6/2018	YES	YES	YES	YES	YES	110	80	76	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
68	KK	202112	50	31-50	MALE	7/6/2019	YES	NO	NO	NO	YES	120	70	80	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
69	SR	452816	46	31-50	FEMALE	6/3/2018	YES	YES	YES	NO	YES	110	70	98	20	F	15	NO	NO	-	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	HYPOTHYROID
70	PS	367938	45	31-50	MALE	13/12/2017	YES	YES	YES	YES	YES	80	80	82	22	AF	15	NO	NO	-	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
71	YS	494464	38	31-50	MALE	8/5/2018	YES	NO	NO	NO	YES	130	80	72	20	AF	15	NO	NO	-	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
72	PA	462071	54	51-70	MALE	20/03/2018	YES	YES	YES	YES	YES	110	80	76	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
73	BS	45257	61	51-70	MALE	23/08/2019	YES	YES	NO	NO	YES	100	60	98	16	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
74	KS	792607	52	51-70	MALE	21/08/2019	YES	YES	YES	NO	YES	110	70	110	24	F	12	NO	YES	-	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	HCV
75	JS	792499	35	31-50	MALE	21/08/2019	YES	NO	NO	YES	YES	120	80	76	16	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
76	GS	794246	30	18-30	MALE	23/08/2019	YES	YES	NO	NO	YES	150	90	82	16	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
77	LSS	788286	52	51-70	MALE	15/08/2019	YES	YES	NO	NO	YES	120	70	78	16	AF	15	YES	NO	-	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	STEROID, PARAPLEGIA
78	NS	763453	60	51-70	MALE	8/7/2019	YES	NO	NO	NO	YES	130	80	74	16	AF	15	NO	NO	7.9	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
79	RK	783889	55	51-70	MALE	9/8/2019	YES	YES	NO	NO	YES	100	60	90	22	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
80	HC	782290	62	51-70	MALE	7/8/2019	YES	NO	NO	NO	YES	110	70	70	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	HTN
81	GD	786249	60	51-70	MALE	12/8/2019	YES	YES	NO	NO	YES	100	60	98	22	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
82	RS	783858	55	51-70	MALE	7/8/2019	YES	YES	NO	YES	YES	110	70	82	16	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
83	DK	788336	57	51-70	MALE	15/08/2019	NO	NO	NO	NO	YES	110	70	80	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
84	GS	176679	77	71-90	MALE	19/08/2019	YES	YES	YES	YES	YES	90	50	100	30	AF	15	NO	YES	7.1	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	HYPERTENSION
85	MK	794862	26	18-30	MALE	24/08/2019	YES	YES	NO	NO	YES	110	70	73	16	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
86	UD	798443	45	31-50	FEMALE	29/08/2019	YES	YES	YES	NO	YES	90	60	98	24	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
87	BS	797398	46	31-50	MALE	28/08/2019	YES	YES	YES	NO	YES	80	40	110	24	AF	13	YES	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
88	RK	101216	76	71-90	MALE	6/9/2019	YES	NO	NO	NO	YES	120	80	70	20	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
89	JS	803639	55	51-70	MALE	05/09/2019	YES	YES	NO	NO	YES	100	60	86	20	AF	15	NO	NO	-	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	HTN
90	KS	803051	54	51-70	MALE	05/09/2019	YES	YES	NO	NO	YES	120	80	87	16	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
91	PS	808086	30	18-30	MALE	11/09/2019	YES	YES	NO	YES	YES	120	80	90	16	AF	15	NO	YES	13.4	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NEUROPATHY
92	SS	116957	38	31-50	MALE	15/09/2019	YES	YES	NO	NO	YES	110	70	80	16	AF	15	NO	YES	-	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
93	AK	810623	18	18-30	MALE	15/09/2019	YES	NO	YES	NO	YES	120	80	98	22	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	SNAKE BITE
94	VJ	810580	67	51-70	FEMALE	20/09/2019	YES	YES	YES	NO	YES	100	60	90	16	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
95	HS	119341	73	71-90	MALE	04/09/2019	YES	YES	NO	YES	YES	120	70	84	16	AF	15	YES	NO	-	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
96	RS	813174	55	51-70	MALE	19/09/2019	YES	YES	YES	NO	YES	100	60	75	16	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
97	JS	819399	75	71-90	MALE	14/09/2019	YES	YES	YES	YES	YES	100	60	80	16	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
98	KS	805285	64	51-70	MALE	07/09/2019	YES	NO	NO	NO	YES	100	60	72	16	AF	15	NO	NO	-	NO	YES	YES	NO	NO	NO	NO	NO	NO	NO	NO	HCV
99	RS	810395	30	18-30	MALE	14/09/2019	YES	NO	YES	NO	YES	100	60	80	16	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	SNAKE BITE
100	SS	296837	69	51-70	MALE	17/09/2019	YES	NO	NO	NO	YES	130	70	76	16	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
101	MS	571623	48	31-50	MALE	21/09/2019	YES	YES	YES	NO	YES	100	70	108	22	AF	15	NO	YES	-	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
102	AKM	818096	34	31-50	MALE	25/09/2019	YES	YES	NO	NO	YES	90	60	110	20	AF	15	NO	NO	-	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
103	VK	676496	60	51-70	MALE	21/09/2019	YES	YES	YES	NO	YES	90	60	100	22	AF	15	YES	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
104	MS	659833	45	31-50	MALE	20/09/2019	YES	YES	NO	NO	YES	100	70	80	20	AF	15	NO	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	HCV
105	SK	817226	70	51-70	FEMALE	24/09/2019	YES	YES	NO	NO	YES	120	80	75	16	AF	15	NO	YES	6.6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
106	SPJ	590160	61	51-70	MALE	26/09/2019	YES	YES	NO	NO	YES	110	80	84	16	AF	15	NO	YES	-	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	COPD, SMOKER
107	AS	810313	34	31-50	MALE	19/09/2019	YES	YES	NO	YES	YES	120	80	76	16	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
108	PK	820115	50	31-50	MALE	28/09/2019	YES	YES	YES	NO	YES	80	40	120	24	AF	13	NO	YES	9.3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
109	GS	825760	31	31-50	MALE	23/09/2019	YES	YES	YES	NO	YES	80	40	110	24	AF	13	NO	YES	-	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
110	SD	791152	48	31-50	MALE	20/08/2019	YES	YES	YES	YES	NO	80	40	120	24	AF	15	NO	NO	-	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
111	SS	791095	42	31-50	MALE	19/08/2019	YES	YES	YES	YES	YES	80	60	120	24	AF	15	NO	NO	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	CRUSH INJURY
112	KD	471336	66	51-70	FEMALE	20/09/2019	YES	YES	YES	NO	YES	130	88	82	16	AF	15	NO	YES	-	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	HTN
113	V	819535	60	51-70	FEMALE	27/09/2019	YES	YES	YES	NO	YES	90	60	108	24	AF	15	YES	YES	-	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
114	JRJ	815329	85	71-90	MALE	21/09/2019	YES	YES	YES	NO	YES	100	60	110	24	AF	12	NO	YES	7.6	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	HTN
115	S	821837	24	18-30	MALE	20/09/2019	YES	YES	NO	NO	YES	100	60	86	30	AF	15	NO	NO	-	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO

S. NO	NAME	MRD	SITE	PAIN	LROT	SKIN DISCOLORATION	SWELLING	ERYTHEMA	BLISTERS	BULLAE	CREPITUS	PUS	NO OF DEBRIDEMENTS	AMPUTATION	SKIN	SUBCUTANEOUS	FASCIA	MUSCLE	PUS	TLC	INR	PLT	UREA	CREATININE	ALBUMN	TOTAL BILIRUBIN	DIRECT BILIRUBIN	SODIUM	BLOOD C/S	CULTURE TYPE
61	DS	347337	FACE	YES	YES	YES	YES	YES	N	N	N	N	2	NO AMPUTATION	YES	YES	YES	YES	YES	6.8	-	365	17	11	-	-	-	146	NO	TISSUE
62	HK	397148	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	N	N	1	NO AMPUTATION	YES	YES	YES	YES	YES	26.5	1.17	246	47	10.78	2.6	0.4	0.2	133	NO	TISSUE
63	JR	784535	LOWER LIMB	YES	YES	NO	YES	YES	Y	N	N	N	1	NO AMPUTATION	YES	YES	YES	YES	YES	13.8	1.7	65	70	1.2	2.4	0.5	0.2	131	NO	WS
64	MS	785931	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	23.7	1.5	244	26	1	2.9	2.4	11.4	136	NO	WS
65	SS	373207	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	12.8	1.12	2.64	67	1.5	-	-	-	132	NO	PUS
66	KM	78543	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	13.1	1.09	449	25	0.6	3.2	0.6	0.64	142	NO	TISSUE
67	HS	513906	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	24.6	1.13	135	50	0.9	3.1	0.6	0.3	142	NO	WS
68	KK	202112	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	-	1.14	-	-	-	-	-	-	131	NO	PUS
69	SR	452816	ABDOMEN	YES	YES	NO	YES	YES	Y	N	N	Y	2	LIMB AMPUTATION	YES	YES	YES	YES	YES	17.3	1.5	305	37	0.3	1.7	2.9	1.4	137	NO	TISSUE
70	PS	367938	UPPER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	13.1	1.4	90	88	4.16	-	-	-	130	NO	WS
71	YS	494464	SCROTUM	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	10.3	1.19	368	30	0.78	-	-	-	140	NO	TISSUE
72	PA	462071	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	8.5	-	554	28	0.7	-	-	-	135	NO	PUS
73	BS	45257	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	0	LIMB AMPUTATION	YES	YES	YES	YES	YES	25.8	1.04	964	39	0.9	2.9	0.2	0.15	131	NO	WS
74	KS	792607	LOWER LIMB	YES	NO	YES	YES	NO	N	N	N	Y	1	PLANNED	YES	YES	YES	YES	YES	66	2.4	80	70	1.5	2.4	11	8	134	NO	WS
75	JS	792499	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	Y	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	9	1.03	356	21	0.8	-	-	-	130	NO	WS
76	GS	794246	LOWER LIMB	YES	YES	YES	YES	NO	N	N	N	N	2	NO AMPUTATION	YES	YES	YES	YES	YES	17.9	1.6	169	60	1.25	2.05	3.6	3.4	128	NO	WS
77	LSS	788286	UPPER LIMB	YES	YES	NO	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	23	1.4	170	54	0.5	-	-	-	141	NO	PUS
78	NS	763453	SCROTUM	YES	YES	YES	YES	NO	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	7.4	1.2	19	151	2.07	-	-	-	130	NO	PUS
79	RK	783889	SCROTUM	YES	YES	YES	YES	NO	N	N	N	Y	1	COLOSTOMY	YES	YES	YES	YES	YES	3.2	1.7	70	48	0.88	-	-	-	122	NO	TISSUE
80	HC	782290	SCROTUM	YES	YES	YES	YES	NO	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	25.9	1.6	150	27	0.7	3.3	0.83	0.5	131	NO	PUS
81	GD	786249	LOWER LIMB	YES	YES	YES	YES	NO	N	N	N	Y	3	NO AMPUTATION	YES	YES	YES	YES	YES	17.7	1.2	252	17	0.42	1.2	0.2	0.05	125	NO	WS
82	RS	783858	LOWER LIMB	YES	YES	YES	YES	NO	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	10.5	1.2	138	46	0.9	-	-	-	135	NO	WS
83	DK	788336	SCROTUM	YES	YES	YES	YES	NO	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	16.1	-	317	32	0.9	4.7	0.3	-	136	NO	PUS
84	GS	176679	LOWER LIMB	YES	YES	YES	YES	NO	N	N	N	Y	1	NO AMPUTATION	YES	YES	NO	NO	YES	8.3	1.1	172	86	4.2	3.04	0.9	0.7	137	NO	WS
85	MK	794862	SCROTUM	YES	YES	YES	YES	YES	Y	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	13.2	1.2	199	30	0.85	-	-	-	138	NO	TISSUE
86	UD	798443	LOWER LIMB + UPPER LIMB	YES	YES	YES	YES	YES	Y	N	N	Y	1	NO AMPUTATION	YES	YES	NO	NO	YES	9.5	1.3	118	60	0.25	1.5	0.4	0.3	130	NO	TISSUE
87	BS	797398	LOWER LIMB	YES	YES	NO	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	22.7	1.4	474	82	5.2	1.9	2.3	2.1	128	NO	PUS
88	RK	101216	LOWER LIMB	YES	YES	NO	YES	YES	N	N	N	N	1	NO AMPUTATION	YES	YES	NO	NO	YES	21.2	1.2	248	67	1.86	3.5	0.4	0.23	140	NO	PUS
89	JS	803639	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	N	N	1	NO AMPUTATION	YES	YES	NO	NO	YES	21.2	1.65	108	32	0.81	2.6	5.8	4.6	128	NO	TISSUE
90	KS	803051	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	18.9	1.17	122	97	1.6	3.09	0.9	0.4	133	NO	TISSUE
91	PS	808086	LOWER LIMB	YES	YES	NO	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	NO	NO	YES	27.1	1.18	217	49	0.9	2.9	0.4	0.25	129	ACINETOBACTER	TISSUE
92	SS	116957	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	NO	11.1	1.5	156	13	0.59	1.5	2.5	1.3	130	NO	WS
93	AK	810623	LOWER LIMB	YES	YES	NO	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	NO	23.3	1.17	167	85	3.05	3.2	1.3	0.4	136	NO	TISSUE
94	VJ	810580	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	26.1	1.7	145	67	0.9	2.7	-	-	135	NO	WS
95	HS	119341	LOWER LIMB	YES	YES	YES	YES	YES	Y	Y	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	5.9	1.4	155	54	1.19	2.6	2.6	1.9	142	NO	WS
96	RS	813174	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	18.9	1.9	100	34	0.95	1.7	5.02	3.98	122	NO	TISSUE
97	JS	819399	LOWER LIMB	YES	YES	YES	YES	YES	Y	Y	Y	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	17.1	1.3	150	25	0.9	2.3	0.6	0.17	130	NO	TISSUE
98	KS	805285	LOWER LIMB	YES	NO	NO	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	NO	NO	YES	10.5	1.19	589	44	1.2	2.4	0.14	0.12	136	NO	TISSUE
99	RS	810395	UPPER LIMB	YES	NO	NO	YES	YES	N	N	N	N	1	NO AMPUTATION	YES	YES	NO	NO	NO	35.2	0.9	26	126	6.6	-	-	-	127	NO	TISSUE
100	SS	296837	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	7.2	1.2	100	58	0.98	2.8	0.69	0.16	135	NO	TISSUE
101	MS	571623	LOWER LIMB	YES	YES	YES	YES	NO	N	N	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	27.6	1.3	259	231	5.07	2.45	1.07	0.92	141	NO	TISSUE
102	AKM	818096	LOWER LIMB	YES	YES	YES	YES	NO	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	12	1.13	256	10	0.29	3.2	0.9	0.7	128	NO	PUS
103	VK	676496	PERIANAL + ABDOMEN	YES	YES	YES	YES	YES	N	N	N	Y	2	COLOSTOMY	YES	YES	YES	YES	YES	21.6	1.6	320	61	0.83	2.5	1.06	0.9	126	NO	PUS
104	MS	659833	SCROTUM + ABDOMEN	YES	YES	YES	YES	YES	Y	N	N	Y	2	COLOSTOMY	YES	YES	YES	YES	YES	21.9	1.4	60	60	1.5	2.4	1.2	0.5	136	NO	PUS
105	SK	817226	LOWER LIMB	YES	YES	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	13	1.17	407	23	0.52	2.46	0.7	0.2	133	NO	PUS
106	SPJ	590160	LOWER LIMB	YES	YES	NO	NO	NO	N	N	N	Y	2	LIMB AMPUTATION	YES	YES	NO	NO	YES	9.6	1.4	315	47	1.6	2.3	1.2	0.8	136	NO	WS
107	AS	810313	LOWER LIMB	YES	YES	YES	YES	YES	Y	Y	Y	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	9.8	1.07	363	30	0.84	3.2	0.7	0.6	133	NO	WS
108	PK	820115	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	12	1.36	185	84	1.49	2.15	5.54	4.72	139	NO	TISSUE
109	GS	825760	ABDOMEN	YES	YES	YES	YES	YES	Y	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	60.8	1.64	80	111	3.9	2.16	1.2	1.02	136	NO	WS
110	SD	791152	LOWER LIMB	YES	YES	YES	YES	YES	Y	N	N	Y	1	LIMB AMPUTATION	YES	YES	YES	YES	YES	7.9	1.02	140	20	0.5	3.2	2.8	2.05	146	NO	WS
111	SS	791095	LOWER LIMB	YES	YES	YES	YES	YES	Y	Y	Y	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	26.4	1.07	229	32	1.77	-	-	-	146	NO	TISSUE
112	KD	471336	LOWER LIMB	YES	YES	NO	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	NO	YES	8.4	1.08	224	190	7.3	-	-	-	132	NO	PUS
113	V	819535	ABDOMEN	YES	YES	YES	YES	YES	Y	Y	N	Y	2	NO AMPUTATION	YES	YES	YES	YES	YES	12.8	1.17	499	70	1.8	-	-	-	130	NO	TISSUE
114	JRJ	815329	LOWER LIMB	YES	NO	YES	YES	YES	N	N	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	16.5	1.34	140	178	5.22	2.72	1.64	0.95	127	NO	TISSUE
115	S	821837	UPPER LIMB	YES	YES	YES	YES	YES	Y	Y	N	Y	1	NO AMPUTATION	YES	YES	YES	YES	YES	28	1.07	502	28	1.15	0.7	0.2	2.6	145	NO	TISSUE

S. NO	NAME	MRD	TIME	ACINETOBACTER	E.COLI	ENTEROBACTER	CITROBACTER	KLEBSIELLA	PROVIDENTIA	PSEUDOMONAS	CLOSTRIDIUM	ENTEROCOCCUS	FUNGAL HYPHAE	MORGANELLA	MRSA	NG	MSSA	STAPHYLOCOCCUS HEMOLYTICUS	STENTOPHOMONAS MALTOPHILIA	STREPTOCOCCUS	POLYMICROBIAL	ICU STAY	MORTALITY
61	DS	347337	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
62	HK	397148	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO
63	JR	784535	POST	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
64	MS	785931	POST	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
65	SS	373207	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
66	KM	78543	INTRA	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
67	HS	513906	POST	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
68	KK	202112	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
69	SR	452816	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
70	PS	367938	POST	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
71	YS	494464	INTRA	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
72	PA	462071	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
73	BS	45257	POST	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
74	KS	792607	PRE	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
75	JS	792499	POST	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO
76	GS	794246	PRE	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
77	LSS	788286	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
78	NS	763453	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
79	RK	783889	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
80	HC	782290	INTRA	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
81	GD	786249	POST	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
82	RS	783858	POST	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
83	DK	788336	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
84	GS	176679	PRE	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO
85	MK	794862	INTRA	YES	YES	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO
86	UD	798443	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
87	BS	797398	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
88	RK	101216	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
89	JS	803639	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
90	KS	803051	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
91	PS	808086	INTRA	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
92	SS	116957	PRE	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
93	AK	810623	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
94	VJ	810580	POST	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
95	HS	119341	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
96	RS	813174	INTRA	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
97	JS	819399	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
98	KS	805285	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
99	RS	810395	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO
100	SS	296837	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
101	MS	571623	INTRA	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO
102	AKM	818096	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
103	VK	676496	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
104	MS	659833	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO
105	SK	817226	INTRA	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
106	SPJ	590160	PRE	NO	NO	NO	NO	NO	NO	YES	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
107	AS	810313	PRE	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
108	PK	820115	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
109	GS	825760	PRE	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
110	SD	791152	PRE	NO	YES	NO	NO	YES	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
111	SS	791095	INTRA	YES	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	NO
112	KD	471336	INTRA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO
113	V	819535	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO	YES	YES	NO
114	JRJ	815329	INTRA	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
115	S	821837	INTRA	YES	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO

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Date 12/11/18

The Principal,
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Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 31.08.2018 has approved the plan of thesis of Tanya Bhalla, a student of your college for **MS General Surgery** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
Clinical evaluation and microbiological profile of necrotizing soft tissue infections

Supervisor
Dr. Ravinder Pal Singh
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Co-Supervisor
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The student may submit the four copies of thesis, to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She may be directed to attach a photocopy of this letter with the forwarding letter while submitting thesis in the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic, if any.

S P Singh

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

31. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
32. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

CLINICAL EVALUATION AND MICROBIOLOGICAL PROFILE OF NECROTIZING SOFT TISSUE INFECTIONS

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

M.S

In

Surgery

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

JANUARY, 2018

DR. TANYA BHALLA

DEPARTMENT OF SURGERY
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	CLINICAL EVALUATION AND MICROBIOLOGICAL PROFILE OF NECROTIZING SOFT TISSUE INFECTIONS
For the degree of	M.S. in General Surgery
Name of the candidate	Dr. Tanya Bhalla
Supervisor	Dr. Ravinder Pal Singh, Professor, Department of Surgery, DMC&H, Ludhiana
Co-supervisor	Dr.Amandeep Singh Nar, Associate Professor, Department of Surgery, DMCH, Ludhiana
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Necrotizing soft tissue infections, characterized by rapid necrosis and tissue destruction, are a rare disease with high morbidity and mortality and may have various presentations, risk factors and microbial pathogens involved. Being a clinical diagnosis, it requires high degree of suspicion. Treatment includes early resuscitation, IV antibiotics and early debridement.

Aim of Study: 1. To determine various clinical presentations of necrotizing soft tissue infections. 2. To determine various microbial causes of necrotizing soft tissue infections.

Materials & Methods: Information will be collected via predesigned proforma, complete clinical examination will be done and culture reports will be analysed in this time bound study. (Extending from January 2018 to July 2019). All patients above the age of 18 years with necrotizing soft tissue infections, diagnosed clinically, requiring treatment in the form of debridement with culture reports shall be included. Patients unwilling for treatment shall be excluded.

Clinical Significance: Significance of this study is that finding the most common presentation of disease and causative micro organism will aid in prompt diagnosis and treatment, considering this is a disease with high morbidity and mortality based solely on clinical diagnosis where early debridement and treatment is the mainstay to a good prognosis

Keywords: Necrotizing fasciitis, necrotizing soft tissue infections, microbiological profile, clinical presentation, risk factors.

(Signature) Candidate	(Signature) Co-supervisor	(Signature) Supervisor	(Signature) Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"CLINICAL EVALUATION AND MICROBIOLOGICAL PROFILE OF NECROTIZING SOFT TISSUE INFECTIONS"** exist in the Department of Surgery, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate herself under our supervision and guidance.

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APPROVAL PROFORMA
BY
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Topic of Thesis	CLINICAL EVALUATION AND MICROBIOLOGICAL PROFILE OF NECROTIZING SOFT TISSUE INFECTIONS
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1. HOD Pharmacology	1. HOD Physiology
2. HOD Surgery	2. HOD Pathology
3. HOD Pathology	3. HOD Pharmacology
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4	DATE OF ADMISSION OF COURSE	31.05.2017
5	TITLE OF THE TOPIC	"CLINICAL EVALUATION AND MICROBIOLOGICAL PROFILE OF NECROTIZING SOFT TISSUE INFECTIONS"

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Necrotizing fasciitis is an infectious disease characterized by rapidly progressive inflammation of fascia resulting in extensive necrosis and tissue destruction.[1] Earlier termed as a "*flesh eating disease*", it can take a fulminant course leading to bacteremia, sepsis and mortality.

Although it is a rare diagnosis (worldwide incidence is about 1 in 100,000 people), [2] it's a clinical one requiring high level of suspicion.[2] Imaging modalities have little use, there are no typical lab findings and scoring systems such as LRINEC [4] are not quite established as a diagnostic tool.

Early diagnosis and early debridement are key to a good prognosis.[1,5] Mortality is increased by 32% if treatment is delayed by even 12 hours. Mortality is upto 25-35%.[6] Pathognomonic signs and symptoms take time to develop, by the time of which there is already rapid spread of necrosis and development of systemic symptoms. Hence it is important to know the diversity of clinical presentations.

Although it more commonly affects the extremities, trunk and perineum, it can affect virtually any part of the body. Presence of risk factors such as diabetes, immunosuppression, chronic kidney or liver disease, [7,8] though may increase morbidity (in the form of increased chances of sepsis and MODS, poor healing, prolonged hospital stay, multiple debridements, failure of graft uptake, even mortality) may not always be present.

Hence there is a need to understand the various forms the disease may present itself so as to facilitate prompt diagnosis and treatment.

Depending on the microorganisms involved, necrotizing fasciitis is classified into different types.[2] Although early resuscitation, iv antibiotics and early debridement are the mainstay of treatment, different causative organisms can take a varied course.[6] Earlier, the most commonly implicated organism, Beta hemolytic streptococcus species, most commonly Streptococcus pyogenes , notoriously famous as the "flesh eating bacteria" has now declined in incidence.[9] Similarly cases of gas gangrene caused by Clostridium species have also declined in incidence with the improvement of sanitation. Hence, along with clinical presentation it is important to know the microbial agents and latest trends, as will be carried out in this study.

Hence, in this study, to take place in DMCH Ludhiana we will address these important issues related to a fatal illness, especially with the paucity of Indian literature on the topic. In addition, This study plans to include not just necrotizing fasciitis but necrotizing soft tissue infections- involving any layer of soft tissue, as they have a similar course and management.[10]

6.2 REVIEW OF LITERATURE

Necrotizing soft tissue infections were described as early as 5th century BC when Hippocrates said "*many were attacked by the erysipelas all over the body when the exciting factor was a trivial accident...flesh, sinews and bones fell away in large quantities, there were many deaths*". [11]

During the American Civil War, American Confederate Army surgeon described "hospital gangrene" which he found to have a 46% mortality rate.[12]

Frank L. Meleney studied the disease in patients in China and was first to discover an infective microbial cause for it- Beta Hemolytic Streptococci, coining the term "Meleney's gangrene" [13]

In 1883, Fournier studied a similar disease occuring in the perineum, still called "Fournier's gangrene" to this date [14]

It was only in 1952 that Dr. B. Wilson named it "necrotizing fasciitis".[15]

Necrotizing fasciitis, a disease of low incidence and high mortality, is characterized by rapidly progressive inflammation of the fascia, causing extensive necrosis of subcutaneous tissue and fascia and abundant tissue destruction.[10] The inflammatory process spreads rapidly, first horizontally then vertically, causing thrombosis which leads to devascularization forming the typical dusky blue patch of skin necrosis and hemorrhagic bullae, sometimes leading to gangrene and the need for amputation.

The disease has an acute onset and a 1-4 day incubation period. In the early stages it may be confused with less severe soft tissue infections such as cellulitis, and presents with swelling and erythema without well defined margins and in this stage the pathognomonic sign is pain out of proportion to presenting signs. Early evidence of bacteremia and sepsis should raise

suspicion.[3] Later on, as disease progresses you see typical heralding signs such as dusky blue patches of necrosis, blistering, bullae, crepitus, "dish water fluid" pus, sometimes gangrene. Bacteremia, sepsis, MODS develop more quickly than in less severe soft tissue infections. Patients often present with associated systemic symptoms such as fever, diarrhea, malaise, nausea, dizziness and dehydration.

There are certain risk factors associated with the disease such as diabetes, Chronic liver disease, Chronic kidney disease, obesity, pre-existing peripheral vascular disease, malnutrition, malignancy, immunosuppression or corticosteroid use, history of abdominal surgery, burns, childbirth.[7,8] There is always almost a preceding history of trauma. For more aggressive organisms, risk factors may not be present.

Literature states the most common organisms causing the disease are beta hemolytic streptococcus, Staphylococcus Aureus, now including MRSA, anaerobes [9] and Vibrio vulnificus (marine organism) [16] and commensals.

Depending on the type of microorganisms implicated, Necrotizing fasciitis is divided into various types:[2,6,10]

Type I:

Polymicrobial. Usually consists of commensals and both anaerobic and aerobic bacteria. Most common presentation and is generally affected with risk factors.[6,8,10]

Type II:

Monomicrobial. Usually aerobic bacteria and Group A Beta hemolytic streptococcus, GAS organisms, most commonly implicated is streptococcus pyogenes, the "flesh eating" bacteria. Other organisms include

Staphylococcus Aureus and nowadays even Methicillin resistant Staphylococcus Aureus or MRSA.[6,10]

Monomicrobial infections are generally more severe and may not be associated with risk factors. There are more chances of early systemic involvement and sepsis, due to exotoxins producing "toxic shock syndrome".[17]

Type III:

Some literature suggests gas gangrene as a third type of necrotizing fasciitis. It is caused by exotoxins released by Clostridium species and anaerobes. It has a characteristic history of minute trauma followed by rapid progression with early features of bullae and necrosis. Crepitus due to gas formation is a pathognomonic sign. In rare cases, Klebsiella can also be a case of gas gangrene in diabetics.[18]

Type IV:

Some literature suggests a fourth type of Necrotizing fasciitis, caused by fungal organisms. This has a long course and poor prognosis and is usually seen in burns patients.

Pathophysiology usually starts with history of trauma, often minute, leading to seeding of organisms. Then there is rapid horizontal spread of inflammation followed by vertical spread leading to thrombosis and necrosis. Different organisms achieve this in different ways. M protein of Streptococcus initiate a rapid inflammatory response. Bacteria releasing exotoxins, such as the supra antigens of Staphylococcus and Streptococcus causing toxic shock syndrome cause massive secretion of pro-inflammatory cytokines by T-cell activation, whereas lecithinase of Clostridium species helps cause lysis of neutrophils

leading to pus formation that is thin- the characteristic "dish water pus". In the case of anaerobes, production of gases such as hydrogen, nitrogen, hydrogen sulphide, and methane lead to destruction of hyaluronic acid and extensive spread and tissue necrosis. Studies have shown that certain mutations occurred in streptococcus pyogenes around 1960, helping it become the "flesh eating bacteria" it is today, leading necrotizing fasciitis to become a public health problem around 1983.[19]

6.3 AIMS AND OBJECTIVES OF THE STUDY

1. To determine various clinical presentations of necrotizing soft tissue infections

2. To determine various microbial causes of necrotizing soft tissue infections

7. MATERIALS AND METHODS

7.1 Source of Data

Data shall be collected from all patients with Necrotizing soft tissue infections, who are admitted during the given time period will be taken for study considering the inclusion and exclusion criteria.

7.2 METHOD OF COLLECTION OF DATA

Information will be collected through predesigned pretested proforma for each patient.

- All patients will be interviewed as per the proforma and a complete clinical examination will be done.
- Samples like tissue, pus and wound swab will be collected under all aseptic precautions and will be transported to microbiology lab for further processing.

In Microbiology lab, the collected samples will be inoculated within 2 hours on to MacConkey and Blood Agar and incubated at 37°C for 24 hours.

The growth will then be identified using standard protocols and Vitek 2.

Further, antibiotic sensitivity testing will be done by Kirby Bauer disc diffusion method/ Vitek 2 system.

INCLUSION CRITERIA

Patients above 18 years of age with necrotizing soft tissue infections requiring surgical debridement.

EXCLUSION CRITERIA-

- Patients less than 18 years of age
- Patients unwilling for treatment

Sample size

Time bound study.

Period of follow-up

Within hospital stay.

Duration of the Study:

January 2018 to July 2019

OUTCOME

Finding most common presentation and microbial agent causing the disease which may aid in prompt diagnosis

STATISTICAL ANALYSIS

The collected data will be evaluated using appropriate statistical methods.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

a) Hemogram including Total leukocyte count, platelets and Hemoglobin
b) PT-INR
c) RFT
d) LFT including albumin levels

e) Culture- in the form of tissue/wound swab/pus taken pre, intra or post-operatively

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached herewith

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PROFORMA

Sr. No_____

Name	Age	Sex
CR.NO	DOA	DOD

Presenting complaints:

h/o trauma?

h/o pain?

h/o systemic complaints?

GPE

BP	Pulse
Respiratory rate	Temperature

GCS:

Presence of Risk factors:

BMI>30	Diabetes Mellitus	CKD
CLD	Alcoholism	Immunosuppression
Malignancy	Burns	h/o TB
h/o surgery	h/o childbirth	BMI < 18
cardiac disease	Other?	

Signature of Candidate

Signature of Supervisor

Local examination:

Site:

Extent:

pain	local rise of temperature	skin discoloration
swelling	erythema	blisters
bullae	crepitus	dish water pus

No. of debridements done:

Amputation

Intra-op findings:

Investigations:

- TLC
- PT-INR
- platelets
- Urea/Creatinine
- Albumin
- Total Bilirubin/direct:
- Blood C/S:
- C/S report

(pus/wound swab/tissue culture), taken (pre/intra/post operatively)

Signature of Candidate **Signature of Supervisor**

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o.....

.....am willing to participate in the study **"CLINICAL EVALUATION AND MICROBIOLOGICAL PROFILE OF NECROTIZING SOFT TISSUE INFECTIONS"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

....

Signature of the Witness Signature of the patient

Name:

Signature of Candidate **Signature of Supervisor**

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य "**CLINICAL EVALUATION AND MICROBIOLOGICAL PROFILE OF NECROTIZING SOFT TISSUE INFECTIONS**" में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"CLINICAL EVALUATION AND MICROBIOLOGICAL PROFILE OF NECROTIZING SOFT TISSUE INFECTIONS" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____ _____

ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

_____

ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____

ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ

CONSENT FOR PHOTOGRAPHS

NAME OF PATIENT: **MRD NUMBER:**

I hereby willingly give my consent to allow Dr Tanya Bhalla, department of general surgery, Dmc&H ludhiana to use clinical photographs of my wound in her thesis project titled "**CLINICAL EVALUATION AND MICROBIOLOGICAL PROFILE OF NECROTIZING SOFT TISSUE INFECTIONS**"

Signature of patient

Signature of Witness With Name

Date

Place